THE ARTE OF NAVIGATION.

Contayning a breife deſcription of the Spheare, vvith the partes and Circles of the ſame: as alſo the making and vſe of certaine Inſtruments. Very neceſſarie for all ſortes of Sea-men to vnderſtand.

Firſt written in Spaniſh by *Martin Curtis*, and tranſlated into Engliſh by *Richard Eden:* and laſtly corrected and augmented, with a Regiment or Table of declination, and diuers other neceſſary tables and rules of common Nauigation.

Calculated (this yeare 1596. being leap yeare) by *I. T.*

Imprinted at London by *Edw. Allde* for *Hugh Aſtley*, by the aſsignes of *Richard Watkins*, and are to be ſolde at Sainct Magnus corner. 1596.

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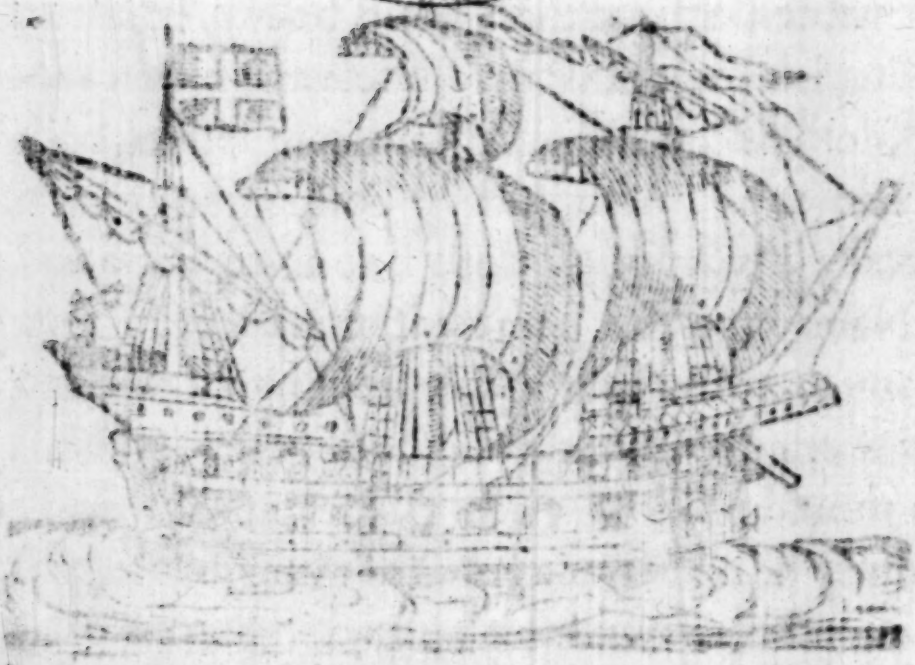


Imprinted at London by *Edw. Allde for Richard Ellis*, by the assignes of *Richard Nicholson*, and are to be solde at Saint Magnus corner. 1596

To the industrious Seamen and Mariners of England, health.

COurteous and friendly Readers, you haue heare presented vnto your viewe, the Arte of Nauigation, being the gathering and practise of *Martin Curtes*, a Spaniard: of whose dexteritie and perfection of Marine causes, the worke it selfe is a sufficient witnes, for that there is no booke extant in the English toung that in so briefe and easie a method, doth discouer so many and rare secrets, both of Philosophy, Astronomy, Cosmography, and generally, whatsoeuer doth belong to good and sure Nauigation: but because it hath beene so often Imprinted, many faultes haue crept into it, through want of ouerseeing and good heed taking, which if they should proceed without corection, it would not onely be a disgrace vnto the Arte (which of it selfe is most commendable) and a discredit vnto the

Author, which is moſt worthy of commendations, but alſo it woulde be a double damage vnto thoſe which should put it in practiſe, for that ſome young Students not being exerciſed in the practiſe of the ſame, and finding ſome error therein, might be diſcoraged to proceed to the knowledge of this moſt exellent Arte.

Therefore for the profit and furtherance of all Seafaring men, to whome I wish, as well as to my ſelfe, I haue vndertaken to ouerlooke the ſame, and (according to my ſmall knowledge in that arte) corrected the faultes vvhich were gotten thereinto: and beſides, knowing how neceſſary it would be to haue a Table of the declination of the Sunne: I haue truly calculated one, and added it hereunto with diuers ſuch Tables, Rules, and Collections vvhich I thought moſt needfull in this matter, and profitable for thy practiſe: of all which if you receiue profit, the Author is worthyly praiſed, and I fully ſatiſfied: therefore committing the worke to your ſtudy and my ſelfe to your fauourable cenſure,

I take my leaue. Vale.

Iohn Tap.

Dayes.		Ianuarie.	Length of the dayes			Daies.		Februarie.	Length of the daie.		
1	A	New yeres day	7	52	a	1	d	Fast.	9	30	e
2	b	Octa. Stephen.	7	55	b	2	e	Purifi. of Mary	9	32	f
3	c	Octa. Iohn.	7	58	c	3	f	Blase. Martyr.	9	36	g
4	d	Octa Innocēt.	8	c	d	4	g	Gilbert confes.	9	40	h
5	e	Depo. of Edw.	8	3	e	5	A	Agathe virgin.	9	44	i
6	f	Twelfth day.	8	6	f	6	b	Dorothe virg.	9	49	k
7	g	Felix & Iann.	8	8	g	7	c	Angulle.	9	52	l
8	A	Lucian Priest.	8	11	h	8	d	Dallamon.	9	56	m
9	b	Ioyce Virgin	8	14	i	9	e	Sol in pisces.	10	c	n
10	c		8	16	k	10	f	Scollastica.	10	4	o
11	d	Sol in Aquaris	8	18	l	11	g	Sother Bishop	10	8	p
12	e	Atlas.	8	20	m	12	A	Eufrase virgin.	10	10	q
13	f	Hillarie Bish.	8	24	n	13	b		10	14	r
14	g	Felicia.	8	27	o	14	c	Valentine.	10	18	s
15	A	Maurice.	8	30	p	15	d		10	22	s
16	b	Marcell.	8	33	q	16	e	Julian virgin.	10	26	t
17	c	Depo. of Anth.	8	36	r	17	f	Germaine.	10	30	v
18	d	Prisca Virgin.	8	40	s	18	g	Hugh Bishop.	10	34	u
19	e	Wolstane bish.	8	43	s	19	A	Simeon.	10	38	r
20	f	Fabian & Seb.	8	46	t	20	b	Wildred.	10	42	y
21	g	Agnes Virgin.	8	50	u	21	c	Lxxix. Martirs	10	46	z
22	A	Vincent mart.	8	53	v	22	d	Peters chaires	10	50	&
23	b	Timothe.	8	56	r	23	e	Fast.	10	54	&
24	c	Emerice.	9	c	y	24	f	Mathie Apost.	10	58	a
25	d	Con. of Paul.	9	4	z	25	g	Inuent. Paule.	11	2	b
26	e	Policarp. mar.	9	6	&	26	A	Nestor.	11	7	c
27	f	Chrisost, doctor.	9	10	&	27	b	Alexander.	11	12	d
28	g	Theodor priest	9	14	a	28	c	Augustine.	11	16	e
29	A	Valerie bishop.	9	18	b						
30	b	Bateld queene.	9	22	c						
31	c	Saturn & Vice.	9	26	d						

Dayes.		March.	Length of the dayes.				Daies.		April.	Length of the daie.		
1	d	Dauid.	11	24	f		1	g	Gilbard.	13	30	k
2	e	Chadde.	11	28	g		2	A	Marie Egipt.	13	34	l
3	f	Maurice.	11	32	h		3	b	Richard Bilh	13	38	m
4	g	Adrian.	11	36	i		4	c	Ambrose.	13	42	n
5	A	Focas & Eufe.	11	40	k		5	d	Vincent.	13	46	o
6	b	Viet & Venin	11	44	l		6	e	Sertus.	13	50	p
7	c	Perpetue.	11	48	m		7	f	Euphemy.	13	52	q
8	d	Depo. of Felix	11	52	n		8	g	Dionisies.	13	56	r
9	e	Fortymartirs	11	56	o		9	A	Perpetuus.	14	0	s
10	f	Agapit.	12	0	p		10	b	Apolinia.	14	2	s
11	g	Sol in Aries.	12	4	q		11	c	Sol in Taurus.	14	4	t
12	A	Gregorie bish.	12	8	r		12	d	Sother.	14	8	v
13	b	Theodor.	12	12	s		13	e	Marcus.	14	12	u
14	c	Candide.	12	16	t		14	f	Liburtie.	14	16	x
15	d	Longine.	12	20	t		15	g	Osmond.	14	20	y
16	e	Hilla & Jonase	12	24	u		16	A	Isidorie.	14	24	z
17	f	Gertude.	12	28	v		17	b	Anisette.	14	28	&
18	g	Edward king	12	32	x		18	c	Elutherius.	14	32	&
19	A	Iose. Ma. huf.	12	36	y		19	d	Alphege.	14	34	a
20	b	Cuthburt.	12	40	z		20	e	Wicto.	14	38	b
21	c	Benedict.	12	44	&		21	f	Simion.	14	42	c
22	d	Afrodose.	12	48	&		22	g	Sother.	14	46	d
23	e	Theodore.	12	54	a		23	A	George Mart.	14	50	e
24	f	Fast.	12	58	b		24	b	Wilfride.	14	54	f
25	g	Annũ of Mar.	13	2	c		25	c	Marke Euang	14	56	g
26	A	Cast or martir	13	9	d		26	d	Clete.	15	0	h
27	b	Merciany.	13	10	e		27	e	Anastatius.	15	4	i
28	c	Rupert.	13	14	f		28	f	Vitales.	15	8	k
29	d	Victorine.	13	18	g		29	g	Peter of Ma.	15	10	l
30	e	Quirine.	13	22	h		30	A	Dep. of Erken	15	14	m
31	f	Adelme.	13	26	i							

Daies.		May.	Length of the daie.			Daies		Iune.	Length of the daie.		
1	b	Philip & Iacob.	15	18	n	1	e	Nichomede.	16	24	r
2	c	Athanasius.	15	20	o	2	f	Marcell.	16	25	s
3	d	Inu. of ỹ crosse.	15	24	p	3	g	Erasmus.	16	26	t
4	e	Christopher.	15	28	q	4	A	Petrocus.	16	27	v
5	f	Godarde.	15	30	r	5	b	Boniface.	16	28	v
6	g	John port Lat.	15	32	s	6	c	Melon.	16	29	u
7	A	John of Beuer.	15	34	t	7	d	Paule Bishop.	16	30	x
8	b	Aper. of Micha	15	36	v	8	e	Trăl. of Edm.	16	30	y
9	c	Transl. of Nic.	15	40	v	9	f	Ianua. confess.	16	30	z
10	d	Gordian.	15	42	u	10	g	Tră of Wolst.	16	30	&
11	e	Anthony.	15	44	x	11	A	Barnard Apo.	16	30	ſt
12	f	Sol in Gemini.	15	46	y	12	b	Sol in Cancer.	16	30	a
13	g	Serustus.	15	48	z	13	c	Anthonie.	16	30	b
14	A	Bonifacemart	15	50	&	14	d	Basilides.	16	30	c
15	b	Isidore.	15	54	ſt	15	e	Vicent Pode	16	29	d
16	c	Discor. mart.	15	57	A	16	f	Tran. of Rich.	16	28	e
17	d	Dunstane.	16	0	b	17	g	Botulphe.	16	28	f
18	e	Bernardine.	16	2	c	18	A	Par. & Marcel.	16	27	g
19	f	Aquilla.	16	5	d	19	b	Gernasius.	16	27	h
20	g	Dunstone.	16	8	e	20	c	Tran. of Edw.	16	26	i
21	A	Barnardine.	16	10	f	21	d	Malburge.	16	25	k
22	b	Helena quene.	16	12	g	22	e	Albone.	16	24	l
23	c	Desiderii.	16	14	h	23	f	Fast.	16	23	m
24	d	Derule.	16	15	i	24	g	Iohn Baptist.	16	22	n
25	e	Urbane.	16	16	k	25	A	Amandi.	16	20	o
26	f	Adelme confess	16	18	l	26	b	Iohn & Paule.	16	19	p
27	g	Bede Priest.	16	19	m	27	c	Christence.	16	18	q
28	A	Germaine.	16	20	n	28	d	Fast.	16	16	r
29	b	Torone.	16	21	o	29	e	Peter & Paule.	16	15	s
30	c	Felix.	16	22	p	30	f	Com. of Paule.	16	14	t
31	d	Petronill.	16	23	q						

Daies.		Iulie.	Length of the daie.		☽
1	g	Octa of John.	16	12	t
2	a	Visit of Marie.	16	10	v
3	b	Trã of Thom.	16	8	x
4	c	Trans of Mart.	16	5	y
5	d	CCC virgins.	16	3	z
6	e	Martalis.	16	2	&
7	f	Zenans mart.	16	0	t
8	g	Depo. of Grem.	15	57	ſt
9	A	Cyrile Bishop	15	54	a
10	b	Dog dais begi.	15	52	b
11	c	Seuen bretherẽ	15	49	c
12	d	Nabor & Felix.	15	46	d
13	e	Sol in Leo.	15	44	e
14	f	Reuell.	15	42	f
15	g	Transl. Suite	15	40	g
16	A	Trãsl. Dimõd.	15	37	h
17	b	Katherine.	15	34	i
18	c	Arnulfe.	15	30	k
19	d	Rufian & Just.	15	28	l
20	e	Margaret.	15	24	m
21	f	Praxede.	15	20	n
22	g	Marie Magde.	15	18	o
23	A	Apolinaries.	15	14	p
24	b	Fast.	15	10	q
25	c	Iames Apostle	15	8	r
26	d	Anne mot Ma.	15	4	s
27	e	Vii. Sleepers.	15	0	f
28	f	Sampson.	14	58	t
29	g	Martha.	14	56	v
30	A	Abdon & Sen.	14	54	a
31	b	German.	14	50	r

Daies.		August.	Length of the daie.		☽
1	c	Lamas.	14	46	x
2	d	Stephen	14	42	y
3	e	Inuent. Sept.	14	38	z
4	f	Iustine.	14	34	&
5	g	Festũ Niuis.	14	32	t
6	A	Trãsl. of Chr.	14	28	a
7	b	Feast of Iesus	14	24	b
8	c	Ciriacke.	14	20	c
9	d	Roman Mart.	14	16	d
10	e	Laurence mar.	14	12	e
11	f	Cutbert.	14	8	f
12	g	Clarie.	14	4	g
13	A	Yiplit.	14	0	h
14	b	Sol in Virgo.	13	56	k
15	c	Assump. Marie	13	52	l
16	d	Roch Mart.	13	50	m
17	e	Octa. Laurẽce.	13	46	n
18	f	Leus.	13	42	o
19	g	Barnerd.	13	38	p
20	A	Dog daies end	13	34	q
21	b	Privats.	13	30	r
22	c	Timothe.	13	26	s
23	d	Fast.	13	22	ſt
24	e	Brathol Apost.	13	18	t
25	f	Lewes King	13	14	v
26	g	Seuerne.	13	10	u
27	A	Rufine Martir	13	8	x
28	b	Augustine bish.	13	6	y
29	c	John beheded.	13	2	z
30	d	Felix & Audas.	12	58	&
31	e	Cutbert.	12	54	ſt

Daies.		September	Length of the daie.	☽	
1	f	Giles.	12 48	a	
2	g	Anthony mar.	12 44	b	
3	A	Lupus Bishop.	12 40	c	
4	b	Transl. Cuthb.	12 36	d	
5	c	Bertine.	12 32	e	
6	d	Eugenius.	12 28	f	
7	e	Nati. Eliz. Reg.	12 24	g	
8	f	Natiu. of Marie	12 20	h	
9	g	Gorgonie.	12 16	i	
10	A	Dilunius Bish.	12 12	k	
11	b	Protec, & Hilt	12 8	l	
12	c	Martinian.	12 4	m	
13	d	Sol in Libra.	12 0	n	
14	e	Holie Crosse.	11 56	o	
15	f	Philetus.	11 52	p	
16	g	Edith.	11 48	q	
17	A	Lambert.	11 44	r	
18	b	Nict. and Cor.	11 40	s	
19	c	Januarie mar.	11 36	s	
20	d	Fast.	11 32	t	
21	e	Mathew Apo.	11 28	v	
22	f	Maricius.	11 24	u	
23	g	Tecla Virgin.	11 20	x	
24	A	Andochius.	11 16	y	
25	b	Fermine.	11 12	z	
26	c	Cipri & Just.	11 6	&	
27	d	Cosme & Da.	11 2	ſt	
28	e	Eruperius.	10 58	a	
29	f	Michael Arch.	10 54	b	
30	g	Hierome priest	10 50	c	

Daies.		October.	Length of the daie.	☽	
1	A	Remigius.	10 46	d	
2	b	Leodegarie.	10 42	e	
3	c	Candide.	10 38	f	
4	d	Fraunces.	10 34	g	
5	e	Apoline.	10 30	h	
6	f	Faith.	10 26	i	
7	g	Martine.	10 22	k	
8	A	Pelagius.	10 18	l	
9	b	Dercon & Mic.	10 14	m	
10	c	Nicasius	10 10	n	
11	d	Edward King.	10 8	o	
12	e	Advocant.	10 4	p	
13	f	Calistes.	10 0	q	
14	g	Sol in Scorpio.	9 56	r	
15	A	Wolfran.	9 52	s	
16	b	Dich. of ỹ moũt	9 48	s	
17	c	Etheldred.	9 44	t	
18	d	Luke Euangel.	9 40	v	
19	e	Fredeswide.	9 36	u	
20	f	Aulterbert.	9 32	x	
21	g	Vi. M. virgins.	9 28	y	
22	A	Mary Salom.	9 26	z	
23	b	Romaine.	9 22	&	
24	c	Magloire.	9 18	ſt	
25	d	Crispine.	9 14	a	
26	e	Vrsula.	9 10	b	
27	f	Fast.	9 6	c	
28	g	Simon & Iude.	9 4	d	
29	A	Narcissus.	9 0	e	
30	b	German.	8 56	f	
31	c	Fast.	8 52	g	

Dies.		November	Length of the daie.			Dies.		December	Length of the daie.		
1	d	All Saints.	8	50	h	1	f	Elegius.	7	36	l
2	e	All Soules.	8	46	i	2	g	Libane.	7	35	m
3	f	Wenefride:	8	42	k	3	a	Dep. Osmond.	7	34	n
4	g	Amantius.	8	40	l	4	b	Barbara.	7	33	o
5	a	Lete Priest.	8	36	m	5	c	Sana.	7	32	p
6	b	Leonard.	8	32	n	6	d	Nicolas bishop	7	32	q
7	c	Wilbrode.	8	30	o	7	e	Ambrose.	7	31	r
8	d	Foure crowne,	8	26	p	8	f	Conc. of Mary.	7	30	s
9	e	Theodore.	8	24	q	9	g	Ciprian.	7	30	s
10	f	Benet.	8	20	r	10	g	Eulalia.	7	30	t
11	g	Martine Bish	8	18	s	11	b	Damase.	7	30	o
12	a	Paterne.	8	16	s	12	c	Sol in Scorpio.	7	30	u
13	b	Sol in Sagit.	8	14	t	13	d	Luce Virgin.	7	30	r
14	c	Transl. Erken	8	11	v	14	e	Nicasius bish.	7	30	y
15	d	Machute.	8	8	u	15	f	Valerius.	7	31	z
16	e	Dep. Edmond	8	6	x	16	g	Lazarus conf.	7	32	x
17	f	Init. Reg. Eliz	8	3	y	17	a	O sapientie.	7	32	x
18	g	Octa Marie.	8	0	z	18	b	Gracian.	7	33	a
19	a	Eliza Martyr.	7	58	x	19	c	Venesta Virg.	7	34	b
20	b	Edmond king	7	55	x	20	d	Fast.	7	35	c
21	c	Præsent Mary.	7	52	a	21	e	Thomas Apo	7	36	d
22	d	Cecili virgin.	7	50	b	22	f	xxx Martirs.	7	37	e
23	e	Clement.	7	47	c	23	g	Victor.	7	38	f
24	f	Grisogon.	7	45	d	24	a	Fast.	7	40	g
25	g	Katherine.	7	44	e	25	b	Christmas daie.	7	41	h
26	a	Line.	7	42	f	26	c	Stephen martir	7	42	i
27	b	Agricola.	7	41	g	27	d	John Euangell.	7	44	k
28	c	Rufus martyr.	7	40	h	28	e	Innocents day.	7	45	l
29	d	Satu. ℂ Fast.	7	38	i	29	f		7	46	m
30	e	Andrew Apo.	7	37	k	30	g	Trã. of James	7	48	n
						31	a	Silvester.	7	50	o

¶ The fyrſt part of this woorke, which entreateth of the compoſition of the worlde, and of the vniuerſall principles for the Arte of Nauigation.

The firſt Chapter, of the generall diſtinction of Creatures.

THE infinite God, the beginning, and cauſe of the whole vniuerſall, created three orders of creatures, differing in kinde: that is to ſay, Corporall, as the Elements: Spirituall, as Angelles: and compounded of theſe two, as Man: The corporall nature is deuided into bright and ſhining bodies, as the Starres: or into darke & thicke bodies, as earth and Metalles: either into Diaphane or tranſparent bodies, as ayre and water. Of theſe creatures (as ſaith Saint Gregorie) ſome haue onely being, as Stones: ſome liue, as Trées: and other haue ſenſe, as Beaſtes: other vnderſtanding, as Man: who in holy Scripture is called all Creatures, according to the ſaying of Chriſt to his Diſciples, where he ſaith, Goe and preache the Goſpell to all Creatures. And therefore not without good cauſe was Man called of ỹ Greke Philoſophers, *Microcoſmos*, (that is) the leſſe Worlde. In the which wee contemplate thinges of no leſſe admiration, then in the great Worlde. The ſimilitude betweene them both is, that euen as the great worlde, and the whole Globe or Sphere thereof, is moued by the voluntarie motion of an intellectiue ſubſtaunce, or an Angell: euen ſo is this. For (as Ariſtotle wryteth) VVhat ſo euer is mooued, is mooued by vertue of another: As, Man is moued by the internall or inwarde fourme that is within him (that is to ſay) by the intellectiue ſoule that is proper vnto him. In like maner, in the great worlde are found diuers moueable thinges: All which, are reduced to one immoueable

Three differences of creatures.

Corporall creatures.

Man is called all creatures, and the leſſe World.

Man compared to the worlde.

All that mooued, is mooued by an other immoueable.

The intellectiue ſoule.

ueable mouer. So in man are founde many thinges mooued by diuers motions, which are al referred to his intellectiue soule. The great worlde contayneth the creatures within it selfe, and consequently is all really, as hauing nothing without it. Euen so, man by knowledge is all, and knoweth al things, and nothing naturally is hyd from him, or vnknowen to him. Againe, in this lesse humane worlde, are two motions, Intellectiue, and Sensuall. Then consequently the great worlde hath two locall motions: The one, wherewith the fyrst moueable is mooued, and draweth with it all the other Spheres from the Easte to the Weast, and is called Rationall mouing. The seconde, is the mouing of the other Spheres, from the Weast into the East: and is called Irrationall mouing. But now leauing to speake of the lesse worlde, we will proceede to speake further of the great.

Man knoweth part of all things.

Two motions in man.

Primum mobile.

Rational motion.

Irrationall motion.

The second Chapter, of the definition of the worlde.

What is the Worlde.

THE worlde (as saith Isodorus) is heauen and earth, & the other workes of God that are conteined therein. It is compounded of thinges visible, and yet vnsearchable. Moses and Saint John the Euangelist witnes that it was made by GOD. The Philosophers called it Mundus a mouendo, because it is in continual mouing and neuer in rest. The Greeks called it Cosmos, which signifieth, Faire, or Beautifull, and so named it, because of the marueilous ornament thereof, and diuersitie of Elementes, with the resplendence or shining of the Sunne, Mone, and Starres. And doubtles, nothing may be seene with the corporall eyes of man, more beautiful then it is. In so much that the diuine Philosopher Plato affirmed, that eyes were giuen to men to beholde the beautie thereof, and to take pleasure in the contemplation of the heauenly bodies and roundnesse of the worlde, whiche also for the roundnesse thereof, is called Spherical, because that Sphera in the Greke tongue signifieth a rounde body.

Or mundus a munditie.

That is clearnes or faires.

Eyes were giuen to men to beholde the faireneſſe and beautie of the Worlde.

The roundnes of the world.

The

The thirde Chapter, of the definition of the Sphere.

THeodosius saith, that the Sphere is a whole and corporall figure, vnder one superficiall: in the middest whereof, is a point or pricke, from the which all ryght lines drawne directly to the circumference, are equall. Definition of the Sphere.

This point or pricke, is called the center of the Sphere: according to Euclide, it is the passage of the circumferẽce of halfe a circle, which is turned rounde about his Diameter that is fixed, vntill it returne to his owne proper place againe, as where it was at the first. By the center of the Sphere, passeth the right line, and the extremities or ends thereof, touch in the circumference. And this line (imagined) is called the Axis or Exeltree of the Sphere, and the endes thereof are called the Poles. Vppon this Axis is the Sphere of the world mooued. The center of the Sphere. The Axis and Poles of the Worlde.

The fourth Chapter, of the diuision of the worlde.

IT is to be presupposed, that there is difference betwene Element, & Elementate, and the fift, being called Quinta Essentia. *Quinta Essentia.*

The Quint essence, or fifte substance, is a body of it selfe, differing frõ al Elements, and things Elementall, aswell in matter as in fourme, and no lesse in nature and vertue: and hauing in it selfe no contrarietie, is certainly without corruption. And hereof commeth it, that the Philosophers called the heauens & heauenly bodies, the fyfth substaunce or fifth essence, by reason of the incorruptibilitie thereof. Aristotle calleth it the fift Element. The v. Essence is incorruptible.

Element is that, whereof any thing is compounded. It is the fyrst of compositions, and of it selfe is not compounded. Whereby it followeth, that neither the earth, the ayre, the water, What is Element. The inferiour Elements are not pure nor simple.

water, nor the fire, that are neare vnto vs, or about vs, are pure and simple Elementes. For these Elementes doo sometimes mingle them selues one with an other, and especiallye where they are neare togeather, and touche one another. Of these Elementes euery part is named by the name of the whole: As euery part of fyre, is called fire, and euery part of earth, is called earth, and so of the other. They are called simple bodies in respecte of other compounde and myxt bodies. They are diuisible into partes of diuers fourmes: and of the commixtion of them, are made and engendred dyuers thynges of sundrye kindes. These foure (that is to meane, Earth, Ayre, Water and Fyre) although they are named simple. but in respecte as aforesaide, yet are they the Elementes [that is to say] beginninges and principles of all other compoundes and myxtes. A pure Element can not be seene, forasmuch as that that is pure, lacketh colour: and that that hath no colour, is not visible. The Elementes [as saith Isodorus] were deuided by the hand of GOD. The imperiall Heauen was replenished with Angelles, the ayre with birdes, the sea with fishes, and the land with men, and other beastes. Elementate, is euery body compounded of the foure Elementes. Not that they are Elementes formally, but vertually in mixt bodies. This knowen, we will shewe howe the worlde is deuided into two regions: Celestiall, and Elementall. The region Elementall, which is continually subiect to alterations, is deuided into foure Elementes: which are, Earth, Water, Ayre and Fire. These Elementes, the Grekes call Ycrogia for the communion and concord that they haue betweene themselues. The heauenly or etheriall region [called Quinta Essentia] compasseth and conteyneth the Elementall world within it.

The elements are diuisible into parts.

The commixtion of elementes.

Pure & simple elements can not be seene.

The diuision of elementes.

What is elementate.

Diuisiõ of the World into Celestiall and elementall.

Quinta Essentia.

The

The fyrſt Chapter, of the number, order, and propertie of the Elementes and Heauens.

THE earth (after the Philoſopher) is a pricke or poynt in the myddeſt, called the center, to the whyche they aſſigne the loweſt place. Next vnto the earth, and about it, the water occupieth the ſeconde place, and the ayre the thyrde. The fyre is hygher then any of the other Elementes. And it is to vnderſtand, that the water hath two ſuperficials. One, whiche is called concaue, or holowe: the other, conuex or embowing. You may compare the inwarde part of the concaue to a dyſhe or a bolle, whoſe outwarde part is called conuex. As touching the concaue, the water compaſſeth about the earth, leauing diſcouered that part that ſerueth for the reſpiration and life of man, and other beaſtes. As concerning whyche, ſome thinke that the Ocean ſea is higher then the earth: and aſke the queſtion why the ſea couereth not the whole earth, and why the earth is not ſunke in the water? To this it may be a ſufficient aunſweare, that it hath ſo pleaſed the will of GOD, according to the ſaying of the Prophete Dauid: Terminum poſuiſti quem non tranſgredietur, neque conuertetur operire terram. That is, Thou haſte appointed limittes, which it ſhall not paſſe, neyther ſhall it returne to couer the earth. Beſyde the will of GOD, which is the cheefe and ſufficient cauſe thereof, we ſay that nature fayleth not in her neceſſaries. For ſhe ſometime admitteth a little inconuenience, to auoide a greater euyll: as when heauie thinges, whiche naturally ſhoulde deſcende, do not onely not deſcende, but riſe vp: And as alſo ſome time it chaunceth that fire deſcendeth, and water aryſeth to fyll the voyde or emptie places leaſte any where ſhoulde bee founde voyde or emptie, whiche nature ſo greately abhorreth. To this purpoſe, nature foreſeeing the kindes of many thynges that coulde not elſe-

The orders of Elements.

Earth. Water. Ayre. Fyre.

The ſourme of the water.

The Ocean Sea.

Pſal. 107. Iob, 38.

The will of God, is the cauſe of cauſes.

Nature abhorreth emptines

where lyue then on the earth, neither bee conserued within the water (as men, and other earthly brastes) determined before to make the earth not perfectlye rounde, contrarye to the nature thereof: whereof it followeth, that it is not altogeather couered of the water. And as (sayth Origen) the earth remaineth discouered of the water, that it myght bring forth fruites, trées, and plantes. As touching the couer aforesayde, the water and earth discouered, are contained vnder the contanitie of the ayre which is diuided into three Regions, as the lowest, highest, and middlemost. The lowest is hotte, by reason of the reflection or reboundyng of the beames of the Sunne, stryken backe by the earth. The highest also is hotte, by participation of the fyre, and neareneste thereunto. The myddle region is colde, as is manyfest by the snowe and hayle, engendreth in the same. The ayre neare vnto the region of the fyre, whiche is pure heate, doth neyther burne nor lyghten, because it hath no combustible matter, and so hath it power, and not acte. It is neare vnto, and reacheth the cyrcle of the Moone, whiche compasseth it about. The heauen, or circle of the Moone, is next vnto the heauen of Mercuri: and Mercuri vnto Venus: Venus, vnto the Sunne: the Sunne, to Mars: Mars, to Iupiter: Iupiter, to Saturne, which is next, and reacheth vnto the heauen of the Starres, called the Firmament, because that in it are all the Starres (except the planettes) firme and fyxt as a knotte in a table. The knowledge of the planets was had by seauen sundry motions they haue among them selues, and by their course, not vniforme to that of the Starres of the eight heauen, because that sometimes the planettes appeare vnto vs ioyned togeather, and sometimes deuided. The Christaline heauen compasseth about, or conteyneth within it the heauen of Starres. This Christaline heauen, is transparent, and perspicuous, as cleare water or glasse that maybee sene through, by reason of the clearenesse and pure substaunce thereof. It is by an other name called, the heauen of water, whereof holy Scripture speaketh saying, Aquæ quæ supra celos sunt, laudent nomen Domini. That is to say, Let the waters that are aboue the heauens, prayse the name of the Lord.

Diuisiō of the aire into thre Regions.

The highest aire is incombustible.

The order of the heauens

The firmamēt.

The planets.

The Christaline heauen.

The heauen of water.

Psal. 141.

Daniel. 3.

Lord. It was created for the conseruation of corporall thynges, and to temper the heate engendred of the mouing of the fyrst moueable, whiche being so great of body, that it not onely compasseth all the Elementes, but also all the inferior heauens is mooued so swiftely, that it dayly perfectly moueth all the aforesayde Spheres. And least by reason of the great heate thereof caused by hys swift motion, it shoulde consume inferior thynges, GOD ordeined this Christaline heauen, that the coldenesse thereof myght temper the extreame heate of the other. This christaline heauen, reacheth vnto the fyrst moueable heauen, called Primum mobile. And this reacheth to the Emperiall heauen, which is the twelfth, called Imperium, by reason of hys clerenesse and resplendence. This is not mooued, and is most perfecte. The Philosophers had no knowledge hereof. But we beleeue by holy Scripture, that suche a heauen there is, and the same to bee the habitation of Angelles, and Spirituall creatures. It is also called Cœlum Cœlorum, that is, The heauen of heauens: because it conteineth and includeth within it all the other heauens. It is of greater clerenesse then all the other heauens, and was created immediatly with the Angelles. In this also remaineth the humanitie of Jesus Christ our GOD, and in dignitie aboue it. It conteineth three holy orders or principalities, called, Hierarchias. Whereof the fyrst is called Supercelestiall, & hath in it also three orders, Seraphims, Cherubims, and Thrones. The seconde is called Celestiall, and conteyneth Dominions, Principates, and Potestates. The thirde, called Subcelestiall, conteyneth Virtutes, Archangelles, and Angelles. And to conclude, it hath abundance of all goodnesse and perfect felicitie, with priuation or want of all euil. The heauen also giueth influence of constancie, stedfastnesse, and durabilitie to thynges, against the durabilitie and inconstancie of the other heauens: the order whereof, doth appeare in the demonstration following.

The mooving of the first. moueable.

The coldnesse of the Christaline heauen.

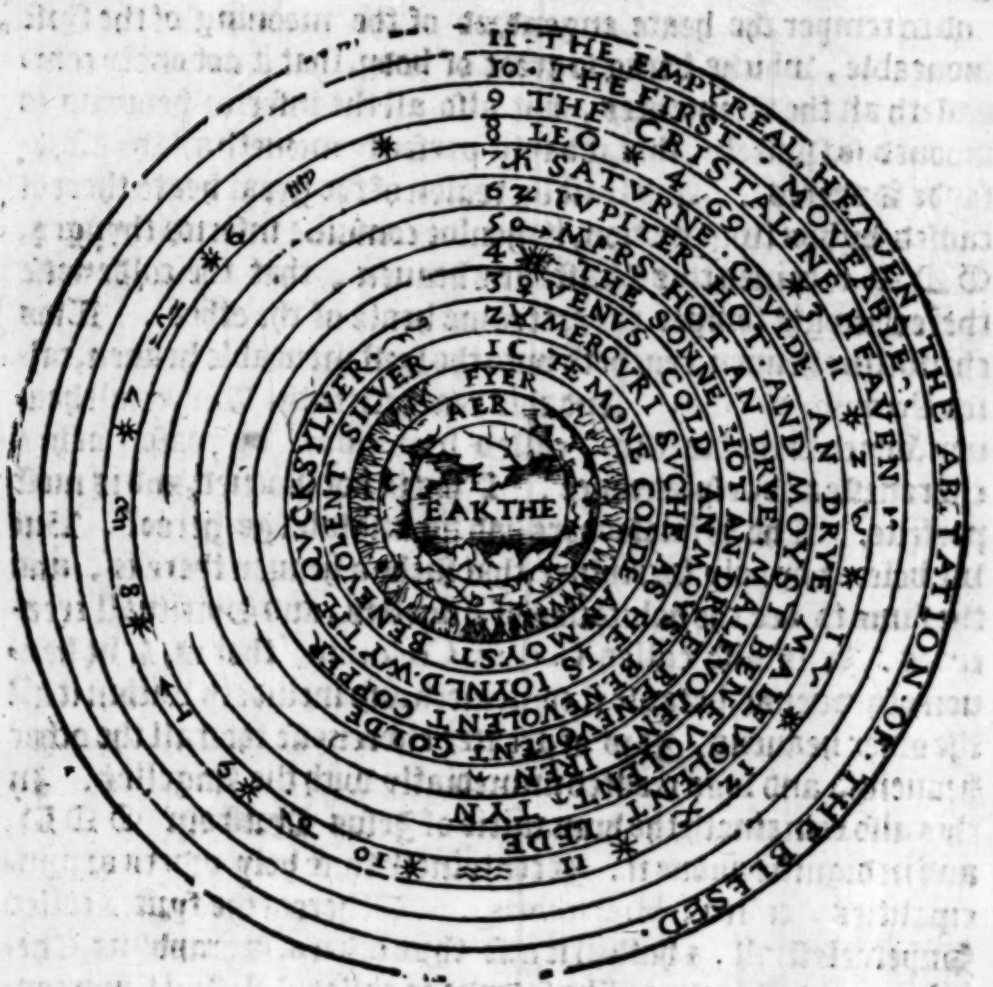
The heauen of the fyrst moueable.

The heauen called Emperium, is not mooued, and is the habitation of Angelles.

The humanity of Christ in the Emperiall heauen.

Three orders of Angelles.

The Emperiall heauen preserueth all the other heauens.



The vi, Chapter, of the immutabilitie or immobilitie of the Earth.

Opinion that the earth moueth. *Molus in loco.*

THe Pythagorians and other auncient naturall Philosophers (as saith Aristotle) were of opinion that the earth did moue, yet not by a right forth motion, but circulerly about the middest of one place. The which errour, both Aristotle himselfe, and the Astronomers do confute, & reproue by euidēt causes, & manifest demonstrations: For circuler motion,

motion, is proper to the heauens. And as the earth differeth from them in natnre, so lyke wyse in mooning. And although it bee so that the earth may naturally moue by certayne of his partes, yet to mooue in the whole, and without the ciruite of his Sphere, it is impossible, beyng founded and established vppon his owne center, the which of it selfe is naturally immooueable: for as much as in it the reason of all heauynes consisteth. Whereas other wyse, euery part that is mooued should ascend, contrarie to the nature of all heauy thinges. But there is founde nothyng heauy that doth not naturally enclyne dyrectly to the center of the earth, and would actually descende thyther, if it had no impediment of some other thynge to resist it: and when it toucheth there, or is come thyther, woulde still rest and remaine there. And hereby it followeth, that the earth, being founded vppon his owne center, is not mooued. The which thinge the Prophete Dauid also affyrmeth, saying, Fundasti terram super stabilitatem suam (that is) Thou foundedst the earth vppon his stabilitie.

The earth is immooueable.

All heauy things encline to the center of the earth.

The earth is founded vpon his own center.

Psa. Cxxx

The vii. Chapter of the roundnesse of the Earth and Water.

THAT the Earth is rounde, it appeareth by manyfest euidence: For if it were plaine or flatte, the dawning of the day or day spring, should equally and at one time appeare to them in the West as to them in the East. But we see the contrary, that it appeareth fyrst to them that dwell in the East, & afterward to them in the West. This is prowed by the Eclipse of the Moone, which beginning at one instant, they of Hierusalem see it begin at foure a clock of the night, and we of Audalusie in Spaine, at one a clocke of the nyght. It followeth hereby, that to them it nighteneth three houres sooner then vnto vs in Spaine: and this is caused by the roundnes of the Earth. It is also as well knowen to be rounde, from the pole Artyke, to the pole Antartyke: For by the roundnesse thereof, is

The roundnes of the earth.

The rising of the Sunne.

The Eclipse of the Moone.

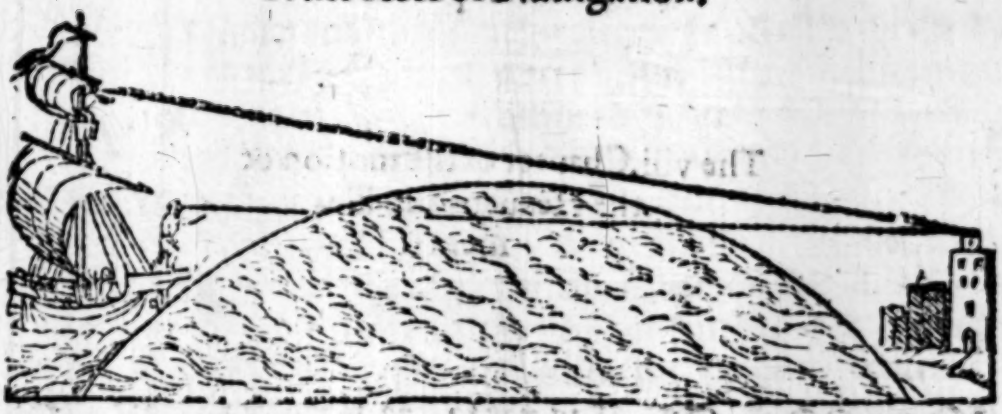
The equalitie of the daies and nightes.

caused the equalitie and inequalitie of the dayes and nyghtes. The same is likewyse knowen by the rayſing of the Pole aboue our Horizon. And that the ſuperficiall part of the earth and water, is all one rounde and ſpherical Globe, is manyfeſt by the ſhadowe thereof, beyng a certaine darke body, reflected from the earth in the Eclipſe of the Moone. For by this, as by playne demonſtration, may wee knowe that the earth is rounde, as may more manyfeſtly appeare by this Fygure. It is alſo prooued, that the water is a rounde body, as is ſeene by experience. For yf you erecte a marke vppon the Sea banke of a Porte, and a Shyppe departe from that Porte a certayne ſpace: then ſtandyng in the Poupe or Sterne of the Shyppe, you ſhall not ſee the marke aforeſayde: but yf you ſtande in the top of the Shippe, then may you ſee it. Whereas notwithſtandyng (yf that portion of the bendyng Arke of the earth dyd not hynder the ſyght) you ſhoulde ſee it better beyng in the Poupe, for as muche as it is nearer to the marke then to the toppe of the Shyppe, as by this demonſtration following, appeareth.

The earth & the water ate one roundle Globe.

The Water is a round body

But



But here some may moue a doubte, saying, that on the earth we may see many mountaynes, and consequently many great Vallyes and Playnes, with many diuersities of sundry other deepe and vnequall places, by reason whereof, the earth cannot truely be called rounde. To this I say, that in two manners, the earth is called and vnderstoode to be rounde. As after one manner, speaking precisely, it is called rounde, as a Circle or a Sphere, whiche we call rounde, because that all right lynes drawen from the center thereof to the circumference, are equall. The other roundnesse, is considered without this preciseneſſe: and is such, as not by all hys partes is equally distant from hys myddest or center, but hath some partes hygher, and some lower, yet not in such quantitie as may destroy the roundnesse of the whole. As if in a Bowle there were certayne clyftes or holes, it shoulde not thereby leaue to be rounde, although not perfectly or precisely rounde. And for this cause saith Auerrois, that although both the heauenly bodies and the Elements are of round fourme, yet differ they in this, that the heauenly Spheres haue perfect roundnesse, and the Elementes not. As the Earth, by reason of his Mountaynes & Vales, the Sea by hys encreasing, and decreasing: the Ayre also for his neareneſſe to the fyre, and by hys contrarietie doeth sometyme doo, and sometyme suffer (that is to say) is sometyme actiue, and sometime passiue. So that following the one, it fleeth the other, by reason whereof, it also lacketh perfecte roundnesse. But the fyre, for as muche as it is neare to the concaue of the Circle of the Moone, which is Spherical, may therefore be called Spherical or rounde.

How the earth is round

The ayre is actiue & passiue, and not perfectly round.

The fyre is rounde.

The viii. Chapter of the motion of the Heauens and Elements.

IT is not to bee forgotten, that all the Elementes are wholy mooueable by locall motion, except the earth. The water is mooued by the motion of the Moone, or tolled by the Windes. The fyre (as saith Aristotle) is mooued circulerly by the motion of the day, and is drawen of the circles that embrace it, or compasse it about: as is manifest by the Cometes, or blasing Starres, and other fyery exhalations, conteined and engendred in it: Which being caried with this motion, conclude, that the fire mooueth in like maner. And with this motion is the superiour part of the ayre violently caried about, as the other impressions therein do shewe. The inferiour part is mooued by diuers motions (that is to meane) laterally, as by experience wée see when the windes blowe. The Moone with her Heauen or Sphere, by her proper motion geueth her turne from the West to the East, in xxvii. dayes, and vii. houres, with xb. minutes. Venus, Mercuri, and the Sunne, in a yeare, which is the space of three hundred threescore and fiue dayes, with fiue houres, and fourtie and niene minutes. Mars in two yeares. Iupiter in twelue yeares. Saturne in xxx. yeeres. The eight heauen, which is the Fyrmament, or starrie Heauen, by his owne proper motion is mooued by the nienth Heauen, vpon the begynning of Aries and Libra and vpon these two pointes accomplisheth his Reuolution in seuen thousand yeares.

How the fire is mooued.

How the ayre is mooued

The Moone.

Venus, Mercurie. The Sunne, Mars.

The starrie heauen or firmament.

This motion is called Motus trepidationis (that is to say) the tremblyng motion, or motion of accesse and recesse. The

The Christaline heauen.

nienth

nienth heauen endeth his motion from the West to the East, in fourtie and niene thousand yéeres: And by this motion moueth the eight heauen. The tenth heauen, called Primum mobile is moued from the East to the West: and in twenty and foure houres (whiche is a naturall day, perfourmeth one reuolution, and with the myghtie force and swiftnesse of hys motion, carieth with him all the other inferior heauens, and maketh them to geue the same turne in twenty and foure houres, where as neuertheleſſe they ceaſſe not in the meane tyme to keepe the course of theyr owne proper motion. As (for example) yf an Ant or Pismire shoulde goe about the wheele of a Mylle, contrarie to the mouing of the wheele: before the Ant in going still forward, shoulde come againe to the poynt from whence shee fyrst departed (whiche is once about, or one turne) the wheels should in that place make many turnes.

First moueable.

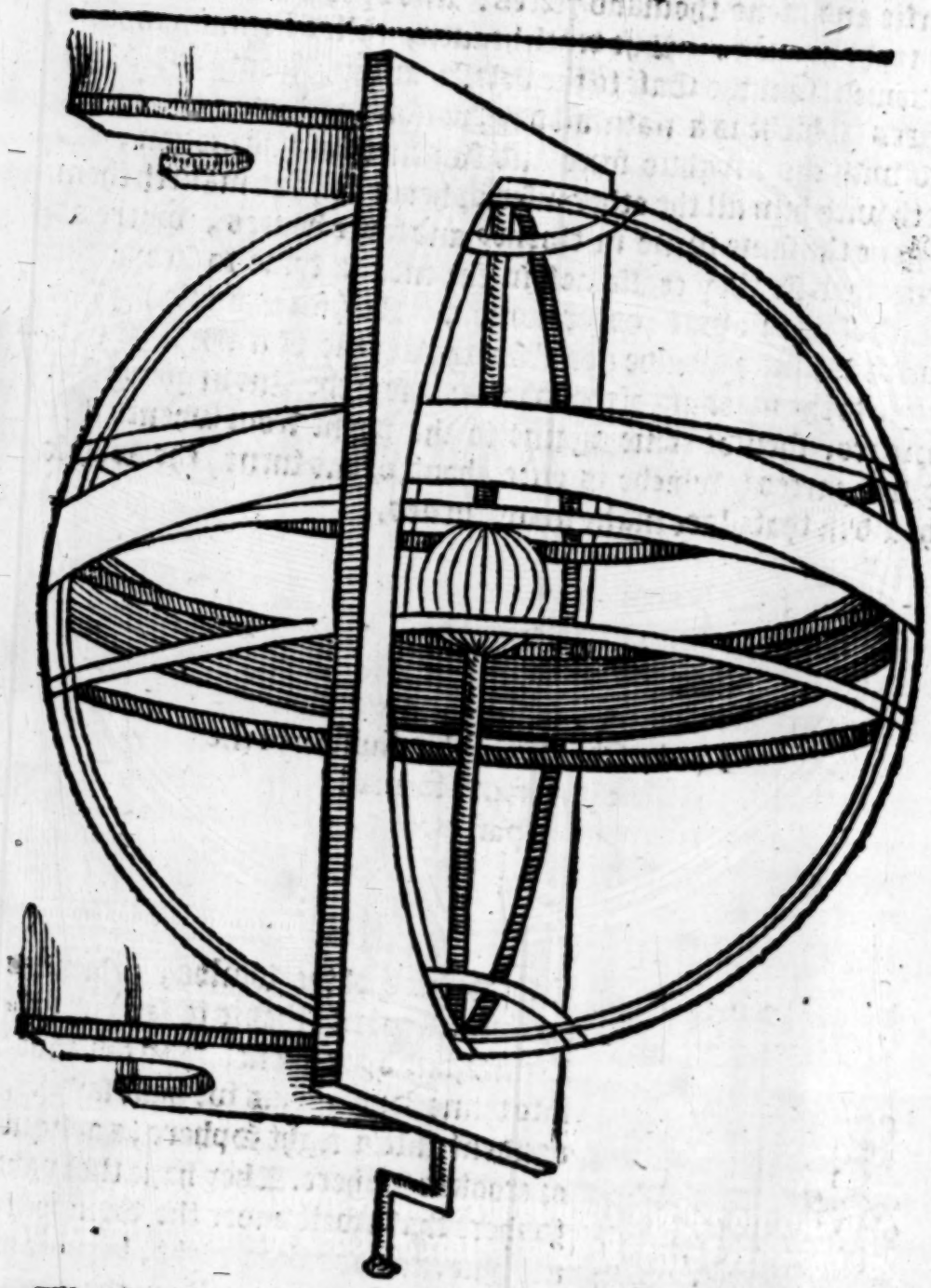
How the first moueable draweth the other heauēs.

The ix. Chapter, of the diuision of the Sphere into formall partes.

THE Sphere of the worlde, is diuided in two manners (that is to say) by substaunce, and by accident. By substance into tenne Spheres, as we haue said. By accident, into a right Sphere, & oblique or crooked Sphere. They haue the ryght Sphere that dwell vnder the Equinoctiall lyne, and is called right, because to them the Poles are equally in the Horizon, as appeareth by this Figure folowing.

The right and crooked or oblique Sphere.

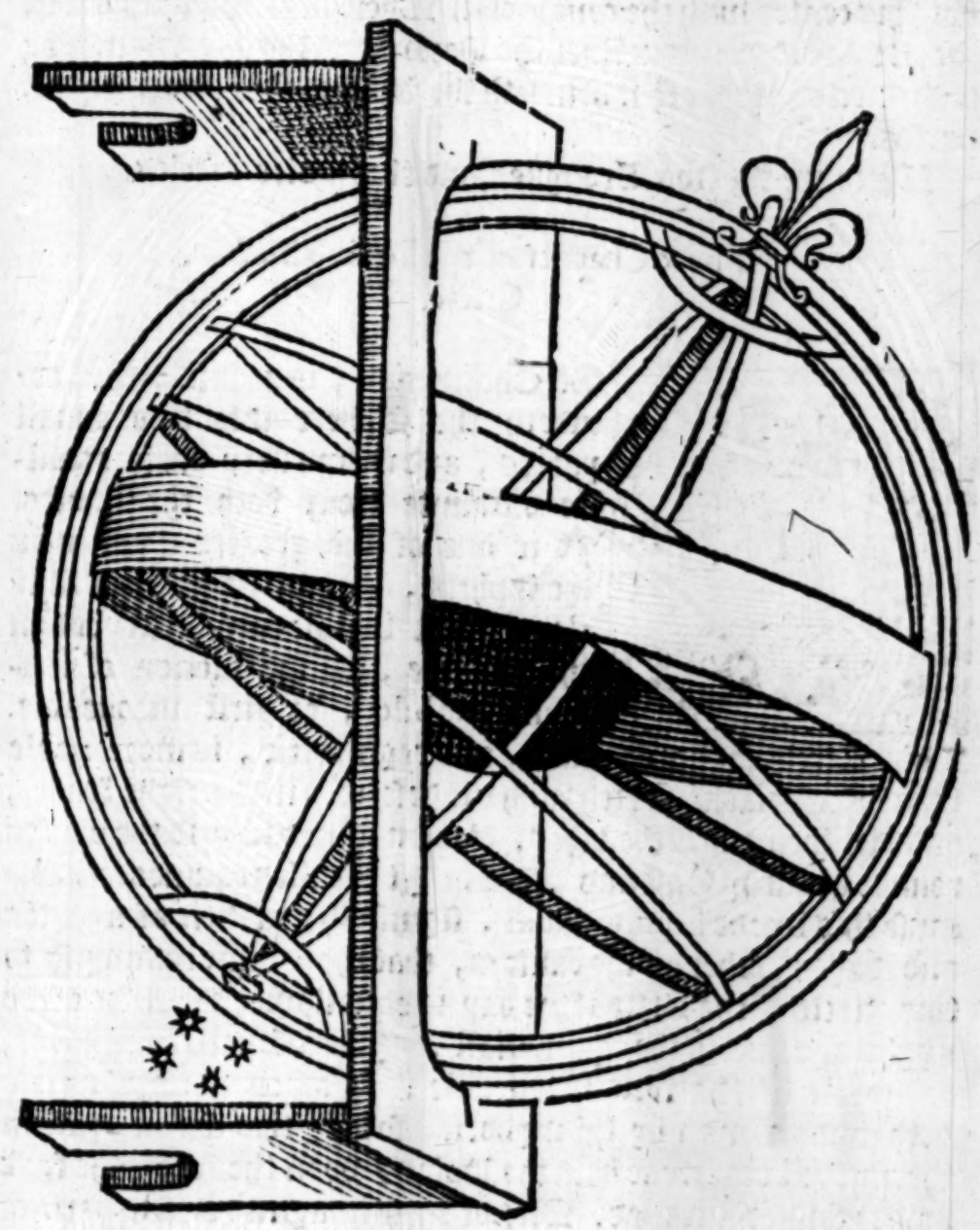
The



The oblique and croked Sphere.

They haue the oblique Sphere that dwell eyther on this side or the other syde of the Equinoctiall, vnto whoume is euer one of the

the Poles aboue the Horizon, and the other vnder it, as appeareth in this Figure.



This Sphere is compounded of tenne circles imagined. And (as saith Iohn de sacro bosco in his booke of the Sphere) fyre

The x. circles of the Sphere

of

of them aregreater, and foure lesse. The greater Circle, is that which deuideth the Sphere into two equall partes, and hath his center with the center of it. These are the Equinoctiall the Zodiacke, the two colnri, the Vozion, and the Meridian. The lesse Circle, is that that deuideth the Sphere into two vnequall partes.

These are the two Tropykes, and two Poler Circles.

The x. Chapter, of the Equinoctiall Circle.

The Equinoctiall.

THe Equinoctiall, is a Circle that deuideth the Sphere into two equall partes, and is by euery parte equallie distaunte from both the Poles. It is one of the greater Cyrcles in the Sphere, and is the greatest Circle of those whiche are descrybed in the Sphere, by the motion of Primum mobile, or first mooueable. This Circle for his equalitie, and regularitie, is more noble then the Zodiacke, which we haue described in the eight sphere, and also then any of the other. It is imagined to gyrd the worlde rounde about by East and West. It is called equinoctiall, because this worde Equinoctium, signifieth equalitie of nyghtes and dayes, whereof the cause is, that the Sunne commyng to this Circle, the Arke of the day is equall with the Arke of the nyght, and then is the equinoctiall. It is also called the Zone, or gyrdle of the fyrst mooueable. For euen as a gyrdle doth gyrde a man by the myddest, so doth this Circle gyrde in the myddest betweene both the Poles, vpon the which the fyrst mooueable is mooued. One of these imagined on our parte of the Sphere, is called Polus Arcticus, because it is neare vnto certaine starres, which the Astronomers call Arcturus, whyche is the great beare. It is called Septentrionall, or Septentrime, because that rounde about it are mooued the vii. starres, whiche make the lesse beare, commonly called Bozina (that is, the horne,

The Equalitie of the day & nyght.

The fyrst mooueable.

horne. The ſtarre which is in the tayle of the leſſer Beare, is called the Northſtarre, becauſe it is nearer vnto the North Pole: the which Pole is a certaine poynt in the Fyrmament, which cannot be ſeene, although the nyght bee neuer ſo cleare. This Starre (as the Poet Homer ſaith) dooth moue little or nothing, becauſe of his little diſtance from the Pole. The other Pole is imagined on the other contrary part, and is called Polus Antarticus, of the worde Ante, whiche ſignifieth againſt, contrary, or oppoſite, becauſe it is on the contrarie parte from the Pole Artike. It is alſo called the South Pole, becauſe that from that part of heauen commeth the Winde, commonly called the South: and is likewyſe called Meridional, becauſe it is ryght South from vs. This is neuer ſeene to vs. They that dwell vnder the Equinoctiall, or come neare vnto this Pole Antartike, haue for a ſigne or marke to know it, foure Starres, in fourme of a Croſſe. And when the greateſt of theſe is loweſt in the foote of the Croſſe, they ſay it is xxv. degrees aboue the Pole. And as we cannot ſee their Pole from hence, ſo they can not ſee our Pole from thence.

The horne.
North ſtarre.

Pole Antartike.

The croſſe neare vnto the Pole Antartike.

The xi. Chapter of the Zodiacke Circle.

THE Zodiacke is deſined to declyne or bende it ſelfe from the Equinoctiall. It is a great Circle which deuideth the Sphere in two Equall partes, cutting the Equinoctiall by oblique or crooked angles: So that beyng thus cutte or deuided by it into two equall partes, one parte thereof declineth towarde the South, and the other towarde North. This Circle is called the Zodiacke, of this worde Zon, which in the Greeke tongue ſignifyeth lyfe, becauſe that according to the mouing of the Planets vnder it, is the lyfe of inferiour creatures: Or is ſo named of Zodion, which ſignyfieth a lyuing beaſt. And is therefore deuided into twelue

Zodiacke.

The twelue ſignes of the Zodiacke.

twelue equall partes, whereof euery part is called a signe, and euery signe hath an especiall name of some beast, in respect of some propertie agreeable to the same: or for the order and disposition of the fixt Starres in those partes, somewhat representyng the similitudes of suche beastes, it is called zodiacke. The Latines called this circle, Signifer (that is) the signe bearer, because it carrieth these signes or images in it also, because the twelue partes, in to the which this circle is deuided, are called the xii. Signes. The parte which declineth to the North conteyneth vi. Signes septentrionall, and the other that declyneth to the South, conteyneth other vi. called Meridionall. Furthermore, it is to consider, that the zodiacke may be deuided in two maners. One, longitude or length into the xii. signes aforesayde, and euery signe is deuided into xxx. degrees, which make. CCCIx. degrees, likewise euery degree is deuided into lx minutes, and euery minute into lx. secondes, and euery secondе into lx. tierces, and so to tenne. The other deuision of the zodiacke is, by latitude or breadth. By latitude it is deuided into xii. degrees, and in it we imagine a lyne that deuideth hys latitude by the middest, hauing vi degrees on euery parte or side. And this lyne, which deuideth into two equall partes the breadth or latitude of the zodiacke, is called the Ecliptike lyne, because that when the Sunne and Moone are directly vnder this lyne, eyther ioyned togeather by coniunction, or deuided by oppositiō, then is the Eclipse of the Sunne or of the Moone. Vnder this zodiacke the seuen planettes are moued. The Sunne also mooueth in the myddest of the sayde zodiacke, alongest the Ecliptike lyne, not enclyning more to the one parte then to the other. But the other Planettes do some time goe towarde the North, and other whyles towarde the South, and some tyme also towarde or trauerse the Ecliptyke. It is lykewyse to bee noted, that these signes whereof wee haue spoken, are not the constellations or starres that make those figures, which the auncient Astronomers dyd appropriate to certaine beastes, and other thynges: For these figures are mooued according to the motion of the eight Sphere, and passe from one signe of the zodiacke to another. As wee see that the starre, called Oculus Tauri.

How the Sun is cause of generation and corruption.

Deuision of the twelue Signes.

Deuision of the signes into degrees.

Deuisiō of the Zodiacke by latitude.

The Ecliptike lyne.

The mooning of the Sun, and the other planets in the Zodiacke.

that

(that is) the Bulles eye, is in three degrées, 42.′. of Gemini. And the two starres that are the head of Gemini are in.xiii. and xvi. degrées of Cancer. And Spica Virginis (that is) the spyke of the Virgin, is in seuentéene degrées, 42.′. of Libra, and the heart of Scorpio in three degrées, 42.′. of Sagittarius. And by this order do they passe from one signe to an other: so that wee may not vnderstand the sinnes by these starres, but the xii. partes of the Arke of the Zodiacke, taking the beginning of the Equinoctiall of Aries. The names of these signes, with their Caractes and qualities, are described in this table here following.

The figures of beastes & other things imagined in heauen besides the xii. signes.

Numb.	*Names.*	*Charac.*	*Qualities.*
1	Aries.	♈	Hot and dry.
2	Taur.	♉	Colde and dry.
3	Gemi.	♊	Hot and moyst.
4	Cancer.	♋	Colde and moyst
5	Leo.	♌	Hot and dry.
6	Virgo.	♍	Colde and dry.
7	Libra.	♎	Hot and moist.
8	Scorp.	♏	Colde and moyst.
9	Sagit.	♐	Hot and dry.
10	Capri.	♑	Colde and dry.
11	Aqua.	♒	Hot and moist.
12	Pisces.	♓	Colde and moyst.

The xii, Chapter, of the Circles, cal'ed *Coluri*.

THere are two circles in the sphere, called Coluri, so named of the Greke word Colon, which signifieth, a member: And of Vros, which signifieth a wylde Ore. The tayle of this beast, maketh a Semycyrcle, or halfe Cyrcle, not perfecte. And as this beast mooueth hys tayle laterally or side wayes, and

aed not by longitude: euen so doe the Colury moue to vs, and are cut in right spherical Angles, vppon the Poles of the worlde. The one passeth by the Poles of the worlde, and by the poyntes of the Equinoctialles, and is called the Equinoctiall Coulure: the other likewise passeth by the Poles of the worlde, and also by the Poles of the Zodiacke, and by the pointes of the Solsticialles, and is called the Colure Solsticiall, called Solstitium, as Solis statio (that is) the standing or staying of the Sunne: because that when the Sunne commeth to this pointe, it declineth no more, but turneth towarde the Equinoctiall. These circles deuide as well the Equinoctiall, as the Zodiacke into foure equall partes, by the pointes of the Equinoctilles and Solstitialles. In the colure Solstitiall, are the greatest declinations of the Zodiacke, which are two Arkes of this Colure, conteined betweene the Equinoctiall and the Zodiacke. And these arkes are equall to the other two of the same colure, included betweene the Poles of the worlde, and the Poles of the Zodiacke.

The Equinoctiall Colure.

The Solstitial Coluret

The greatest declination of the Zodiacke.

The xiii. Chapter, of the Meridian Circle.

Definition of the Meridian Circle.

THE Meridian, is one of the great Circles, imagined to trauerse the Sphere by the Poles of the worlde, cutting the same in two equall partes by the zenith or verticall poynt. It is called Meridian for this effect, that wheresoeuer a man becommeth, and at what soeuer tyme of the yeare, when the Sunne (by the mouing of the first moueable) shall come to the Meridian, to him shall it be high noone at midday, and is therefore also called the circle of the midday.

The Midday or noone.

It

It is also to be noted, that there are as many Meridians, or Meridian lynes, as are differences or habitations by longitude: so that they that dwell in the East, haue other Meridians then they that dwell in the West: So that the interposition of the Arke of the Equinoctiall, betwæne the Meridian of one Citie, and the Meridian of the other, is called the difference of longitude from one Region to another, and from one Cyty to another, as we will further declare hereafter.

Diueres Meridians.

The xiiii. Chupter of the Horizontall Circle.

THE Horizon (after the Astronomers) is a Circle which deuideth that parte of the heauen which we do see, from the other part which we see not, so that ỳ said Horizon deuideth the Sphere of ỳ world into two equall halfes, called Hemispheres. The halfe which we do see is called ỳ Hemisphere superior, and it which we see not, is called the Hemisphere inferior. This Horizon, chaungeth to them that mooue: for as one dooth mooue, his Horizon doth chaunge. And heereof it commeth, that how many places are vpon the earth, and the circumference thereof, it is possible there should bee so many Horizons. The Astronomers suppose the Horizon, after two maner of sortes, that is to say, a right Horizon, and an oblique, or crooked Horizon. The ryght Horizon, is to them whose zenith or verticall poynt is directly in the Equinoctiall: and this ryght Horizon, passeth by the Poles of the world, and deuideth the Equinoctiall in right spericall angles. The other oblique or declyned Horizon haue they, Unto whom the Pole of the world doth ryse abous their Horizon. This Horizon is also called oblique, because it deuideth the Equinoctiall in vnequall and oblique or crooked angles.

Definition of the Horizon.

Hemisphere or Horizon.

Diuers Horizons.

The right and oblique Horizon.

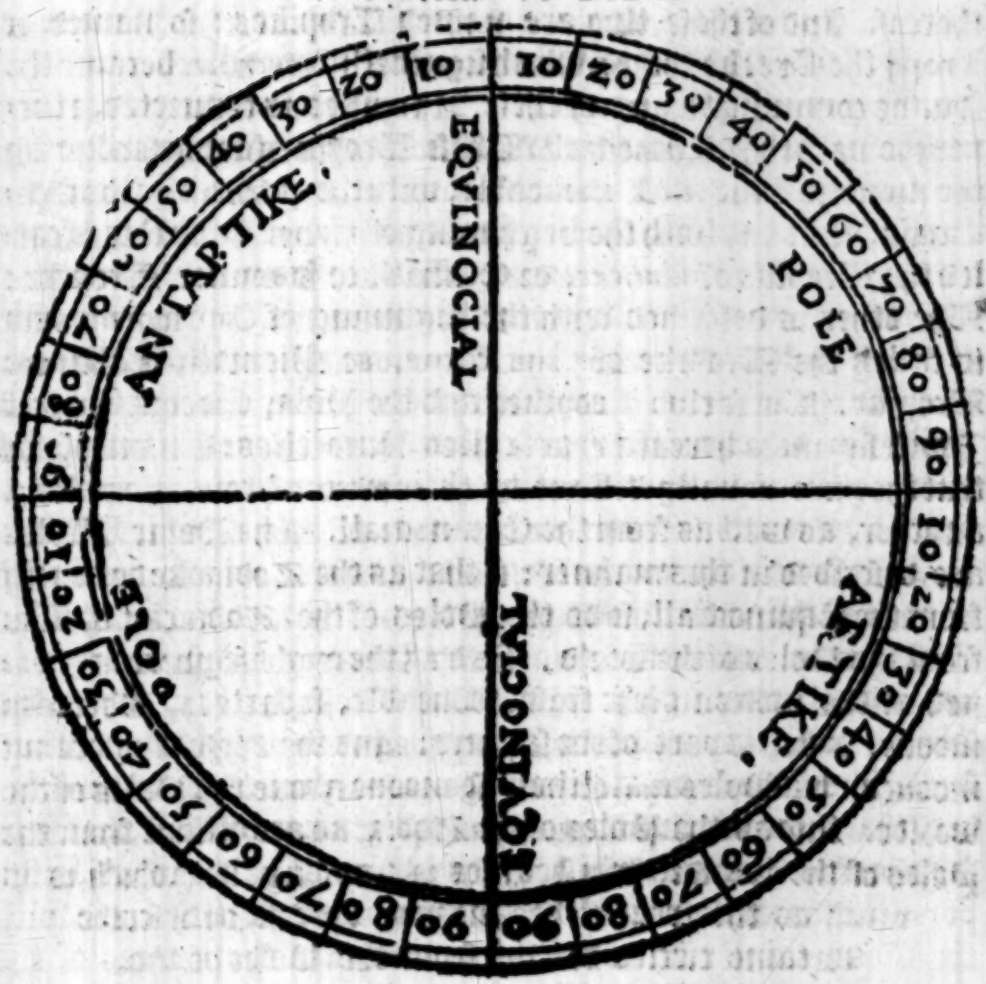
Also it is to bee vnderstood, that the Pole of the Horizon is called Zenith, or the verticall poynt of heauen, perpendicularlye, or directly ouer our head. Whereby is inferred, that as muche as is the elevation of the Pole of the worlde aboue the Horizon, so muche is the distaunce of the Zenith from the Equinoctiall. For the Zenith by all his partes, is distaunt from the Horizon by ninetie degrees. And all other impedimentes excluded, we may euer see halfe the heauen: And in as muche as any shall passe from the Equinoctiall, towarde the one Pole or the other, so much falleth the Horizon vnder or beneath the Pole, towarde the course hee entendeth, and likewise as muche shall it be raysed aboue the contrary Pole, as shall appeare by a demonstration in the ende of this Chapter. This Horizon is deuided by the Meridian into two equall parts: that is to say, the East and West partes of the sayd Horizon. The East part is, where the Sunne and Starres begin to aryse to vs, and appeare in our sight. The West parte is, where the Sunne and Starres dooth set and begin to be hydde out of our syght, vnder the sayde Horizon. Moreouer, it is to be vnderstanded, that there bee two manners of the East and West, that is to say, the true East and West, or the vntrue. The true East, is the poynt in the East part of the Horizon, where it doth cutte with the Equinoctiall: for when the Sunne is in the poyntes of the Equinoctiall, then he ryseth in the poynt of the true East. And lykewise is to be vnderstanded of the poynt of the true West, to be in the West part of the Horizon, where the Equinoctiall doth cutte with the sayde Horizon. The vntrue East and West is variable, accordyng as the Sunne ryseth and setteth daylye in dyuers poyntes of the Horizon, which is distant from the poyntes of the true East and West, sometymes more to the Northward, and sometymes more to the South.

Distance of the Zenith from the Equinoctial.

How the Horizon is deuided by the meridian.

The true and vntrue East and West.

The



The xv. Chapter, of the foure lesse Circles.

HAuing entreated of the .vi. biggest Cirtles, it remaynethto speake of the foure lesse Circles. The lesse Circles.

A lesse Circle (as we haue sayde before) is that, whose superficiall deuideth the Sphere into vnequall partes, not passing by the Center thereof.

thereof. And of these, two are named Tropikes: so named of Tropo the Greeke worde, which signifieth *Conuertion* because the Sunne comming to any of these Tropikes, is conuerted, & turneth toward the Equinoctiall. These Tropikes are described by the motion of the first moueable, with the poyntes of the Solstitials. The one with the begynning of Cancer, and this is called the Tropike of Cancer, or Estiuall, or Sommer Tropike: The other is described with the beginning of Capricorne, and is called the Tropike of Capricorne, or Hiemall, or Winter Tropike. These two Tropikes and the Polar Circles (wherof I will say more hereafter) are called Paralelles: so named, for that they are equally distant by their circumferences one from an other, as well as from the Equinoctiall. The Polar Circles are described in this manner: so that as the Zodiacke declineth from the Equinoctiall, so do the Poles of the Zodiacke decline from the Poles of the world. And as the eyght Sphere is mooued at the motion of the fyrst moueable, so shall the Zodiacke moue, which is part of the Sphere. And the Zodiacke beeing mooued, his Poles shall likewise moue aboue the Poles of the world. And as the Poles of the Zodiacke are distant from the Poles of the world, xxiii. degrees 28.′. and a halfe (which is as much as the greatest declination) they shall describe certaine circles distant from the Poles of the world, in the selfe same. xxiii degrees 28.′. and a halfe. These Polar Circles, take they name or dominion of that Pole of the world that is most neere vnto them, and therefore is the one called Artike, and the other Antartike.

Tropykes.

Paralelles.

The Polar Circles.

The Poles of the Zodiacke and Poles of the worlde.

The greatest declination of the Sunne.

The Artike, and Antartik.

* * *

The

The xvi. Chapter, of the fyue Zones.

THe ancient Astronomers, deuided the Sphere vnto. v. Zones: the first, from the Pole Artike, to the Circle Artike. The second, from the Circle Artyke to the Tropike of Cancer. The thyrde, from the Tropike of Cancer, to the Tropike of Capricorne. The fourth from the Tropike of Capricorne, to the Circle Antartyke. The fifth, from the Circle Antartyke, to the Pole Antartike. Of these fyue Zones, they haue certaine knowledge, that two of the Poles were vnhabitable for extreame colde: and also that the burnt Zone (called Porida Zona) whereby the Sunne passeth by the middest of them, should be vnhabitable for extreame heat. That from the Tropike of Capricorne, vnto the Circle Antartyke, they called dezert, because they knew not that it was inhabited. And this our Zone, that is, from the Tropike of Cancer, to the Circle Artyke, they called inhabited or habitable. And to haue more perfect knowledge hereof, it is to imagine, that the earth is deuided proportionally into fiue Regions or Portions, which answere directly to the saide fyue Zones, as saith the Poet Ouid in this verse.

The Sphere deuided into fiue Zones.

Zones habitable and vnhabitable.

The diuision of the earth according to the fiue zones of heauen.

Totidemque plage, tellure præmunter. *(That is)*
And so many Regions are on the earth beneath.

Euery of these Regions or portions of the earth, is situate vnder one of the fiue Zones aforesayd. But whereas certaine men of authoritie haue mooued the question, whether the earth vnder the Zone, from the Tropike of Cancer, to the Circle Antartyke, is dezert or no: Ptolomie and the Astronomers affyrme, that it is vnpeopled. But Aristotle & Ouid in the second of his *Metamorphoses*: Plinie, also and Iohn De Sacro bosco, affyrme the contrary: as for the more certaintie therof we know the experience of such as goe & come dayly from those partes. Moreouer then this, we knowe that that lande is not only well replenished with people of good corporature, and of white colour, but the same to bee also very rich in Golde. For they that sayle to the East Indies,

An errour of Ptolomie & the Astronomers.

touch in the caye of Buena ſperanza, or Caput bonæ Spei, which
The lande of Braſile is in this Zone. Lykewiſe the land of Braſile, and the confines
The ſtraights of Magaliancs of Rio de la Plata, with all the coaſt, vnto the ſtraightes of Ma-
galianes, euen vnto the. 54. degrees of the ſouth part. This land
was diſcouered by Magalianes, in the yeere. 1520. or. 1521.
wherby that is now well known by ſight, wherof Ptolomie had
no knowledge by heare ſay. The burnt Zone (called Torida zo-
na) they alſo deſcribed to be vnhabitable, by reaſon of the great
heate thereof, as Ariſtotle, Plinie, and in maner al other ancient
authours affirme: whereof the Poet Virgil writeth thus.

Quinque tenent cœlum Zonæ, quarum vna corruſco.
Semper ſole rubens, & torrida ſemper ab igne.

Which in the Engliſh tongue is thus much to ſay in effect.

In Zones fiue, the heauens contained be,
Whereof the one with burning Sunne is red:
Scorching the Earth ſubiect to his degree,
That for the heate thereof it is vnhabited.

Lykewiſe Ouide in his Metamorphoſes, toucheth the ſame, ſaying.

Quarum quæ media eſt, & torrida ſemper ab igne. &c.

Yet that the burnt Zone is inhabited, and wel repleniſhed with
people that liue there, we know ſo certainely by the number of
The weſt Indies. thē that dayly paſſe to & fro the Indies, that to ſay any thing to the
contrary, it ſhould be a manifeſt errour, & therfore is it greatly to
be meruailed, that certeyne wiſe men haue affirmed theſe parts
to be vnhabitable: whereas neuertheleſſe they had knowledge
of Arabia Foelix, Aethiopia, Taprobana, and dyuers other Re-
gions ſituate vnder the burnt Zone. Plinie writeth, that a ſhyppe
came from the ſea of Percia by the Ocean, round about Ethiope
and came to the pillers of Hercules, which is now the Cittie of
Cadiz, where at this preſent I writte this briefe treatiſe. They
of Guinea, Calicut, Gatigara, and Malaca, lyue all vnder the
People of long life vnder the zone. burnt Zone, and many of them liue very long. And doubtleſſe,
many thinges ought to perſwade vs, that vnder the burnt Zone,
the earth is furniſhed with all thinges pertaining to the lyfe of
man: for that in that region, or portion of the earth, is in maner

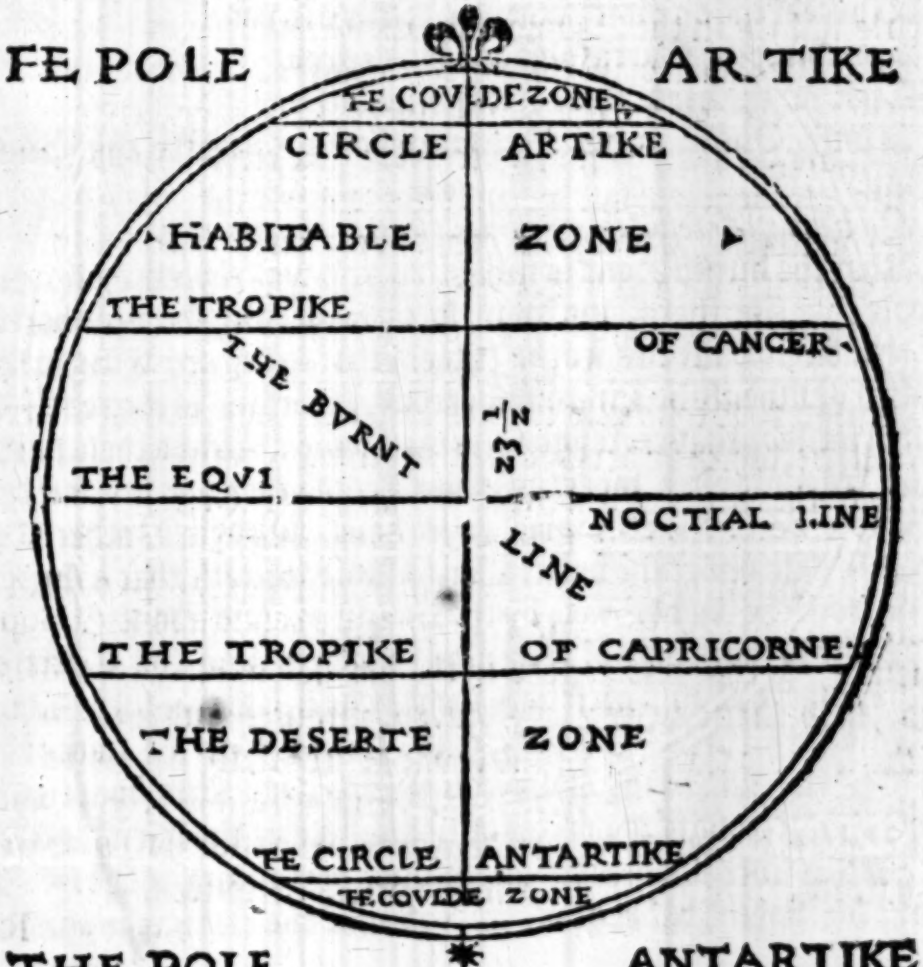
continuall

continuall Equinoctiall, and the coldnesse of the nyght doth sufficiently temper the heate of the day. Agayne, they that inhabite vnder that Zone, haue two Sommers, and two Winters in the yeere: whereby is concluded that the auncient anthours erred, not onely in affyrming this Zone to be vnhabitable by reason of the great heate thereof, but in like maner erred, in affyrming the Zone that is betweene the circle Artike, and the pole Artike, to be also vnhabited by reason of great cold. The contrary whereof, we may well affirme, knowing as wee knowe that Islande, with part of Gothland. Norway, Russia, and dyuers other Landes, are inhabited and well peopled.

Cold Regions habitable

Islande. Gothlande, Norway. Russia.

¶ This is the figure and demonstration which followeth.



The xvii. Chapter, of longitude and latitude, and of the proportion which the lesse circles haue to the great circle.

The diuision of the sphere by longitude and latitude.

THe sphere or globe of the earth is also diuided in breadth and in length. The breath (which is called latitude) is by degrees: for from the Equinoctiall, to eyther of the two poles, is. 90. degrees. The length (which is called longitude) is by ỹ degrées of the Equinoctial, which is deuided in 360. degrees. The fyrst degree of longitude, doth begyn at a certayne Meridian, which passeth by the Ilandes of the Azores, called the fyred Meridian: and the order of the numbring of the sayde longitude, is alwayes towarde the East. By euery degree of the sayd longitude in the Equinoctiall, may be vnderstanded a great circle (called Meridian) to passe, eachons of them passing and mæting in the poles of the worlde, so that the said great circles, or meridians, doth deuide euery paralel or lesse circle, proportionally into. 360. degrees: but we must not vnderstande these degrees to be equall (that is to say) as great in one circle, as in an other: for the greater the circle is, the greater is the degree in it: and the greater the paralell is, the neerer it is vnto the Equinoctiall line. Euery degree of the Equinoctiall, conteyneth in longitude 60. minutes, so lykewise it is to be vnderstanded of the degrees of latitude, which be deuided each one into. 60 minuts of latitude, because the degrees and minutes in the great circles, doo not dyffer in their bignesse the one from the other: but the degrees in the paralels, as they are distaunt from the Equinoctiall, and come neere to eyther of the two Poles, they dyminyshe consequently, so that one degree in the paralel, of 7. degrees of latitude, doth make in quantity but. 59. minutes and. 33. secondes of the Equinoctiall circle: and to one degree in the paralell of. 12. degrees of latitude, goeth but. 58. minutes, and. 41. secondes of the Equinoctiall, and to one degree in the paralel of. 16 degrees of latitude, there goeth. 57. minutes, and. 41. secondes.

The degrees of the Equinoctial circle

The

The Table of minutes, which euery degree containeth in euery of the paralellelles.

☉	☽	♄	☉	☽	♄	☉	☽	♄	☉	☽	♄	☉	☽	♄	☉	☽	♄
1	59	59	16	57	41	31	51	26	46	41	61	29	5	76	14	31
2	59	58	17	57	23	32	50	53	47	40	55	62	28	10	77	13	30
3	59	55	18	57	4	33	50	19	48	40	9	63	27	14	78	12	28
4	59	51	19	56	44	34	49	45	49	39	22	64	26	18	79	11	27
5	59	46	20	50	23	35	49	9	50	38	34	65	25	21	80	10	25
6	59	40	21	56	1	36	48	32	51	37	46	66	24	24	81	9	23
7	59	33	22	55	38	37	47	55	52	36	56	67	23	27	82	8	21
8	59	25	23	55	17	38	47	14	53	36	7	68	22	26	83	7	19
9	59	16	24	54	49	39	46	38	54	35	16	69	21	30	84	6	15
10	59	5	25	54	23	40	45	58	55	34	25	70	20	31	85	5	14
11	58	54	26	53	56	41	45	17	56	33	33	71	19	32	86	4	11
12	58	41	27	53	28	42	44	35	57	32	41	72	18	32	87	3	8
13	58	28	28	52	59	43	43	53	58	31	48	73	17	33	88	2	5
14	58	13	29	52	29	44	43	10	59	30	54	74	16	32	89	1	3
15	57	57	30	51	58	45	42	26	60	30	0	75	15	32	90	0	0

The xviii. Chapter, of the circuite or compasse of the *Earth and Water, according to the opinion of the auncient and latter authours.*

IT may heere appeare to bee necessarie, for our purpose, to declare what space of the superficie of the earth or water, the auncient writers did suppose to aunsweare to one degree of a greater circle in the heauen: for in dyuers countries, they vsed to count by dyuers sortes or maner of measures: as, the Latines counted by myles, the Greekes by furlonges, the Spaniardes and Frenchmen by leagues, the Egiptians by sygnes or markes, and the Persians by

Miles.
Furlonges.
Leagues.

Grayne. Fynger. Foote. Pase.

by saguas. But they all agree, that foure graines of Barly make a finger breadth: foure fingers, a hande breadth: foure handes a foote: fiue foote, a Geometricall pase (for two simple pases, make fiue feete.) Also. 125. Geometricall pases, make a furlong: eyght furlonges, one myle: which is a thousande pases: and three myles, one league. In Germanie they make leagues of more feete, and in some places more then in other. In Fraunce, they count thyrtie leagues, to one degree. The Spanyardes, count sixteene leagues and two terces, and seuenteene and a halfe for a degree of the great circle: this difference that one league is bigger then another, may come heereof, that one Barly corne is bigger then another. But to our purpose, let vs giue to euery league three thousand pases, and to euery pase fiue foote, and so shall euery league haue .xv. thousande foote. In the Cardes of the sea, that haue their degrees of .xv. leagues and two terces, we say: that of these, the roundnesse of the lande and the water conteineth fyre thousande leagues. And in the Cardes that haue seuenteene leagues and a halfe for a degree, of these we say that it conteyneth fyre thousande and three hundred leagues. And who so desyreth to knowe howe muche is the Diameter of the earth and water, may know it by multiplying the circumference by seuen, so that deuiding the summe that riseth thereof by twentie and two, the part that ryseth of that calculation, shalbe the Diameter: and the halfe thereof, shalbe the semidiameter.

The degrees of the sea Cardes.

The diameter of the earth and water.

The .xix. Chapter, of the seauen Climates.

Diuision of the earth and water by Climates.

THE auncient authours dyd also diuide that part of the superficie of the earth, on the Northside the Equinoctial, which they supposed to be most habitable, into seauen Climates, wherein they did finde to bee dyuers conditions and customes of men, and dyuersities of beastes: and of other naturall thynges: the which thinges they

Diuersities of thinges in diuers Climats.

they perceyued to haue a diuersitye in the Countryes, as where the day of the one did increase or dyffer aboue the day of the other by halfe an heure, so that the space of the superficiall of the earth betweene two paralell lynes, wherein the longest day doth increase or dyffer by halfe an houre, is called a Climate. The place where they suppose the fyrst climate to begin, is distaunt in Latitude from the Equinoctial by. 12. degrees, and. 45. minutes, where the longest day is. 12. hours, and. 45 mintes, and the place where the seuenth climate doth finish, is in the Latitude of 50. degrees, and. 30. minutes, where the longest day is. 16. hours, and 15. minutes, so that the increase of the longest day in the ende of the seuenth climate, dooth exceede it in the beginning of the fyrst climate by three howres and a halfe: and the whole compasse of the earth, with all the seauen climates, doth conteyne in breadth. 37. degrees, and. 45. minutes, but their length is supposed to extende to. 180. degrees of longitude. In that manner, a climate, the neare it is vnto the Equinoctiall, the more it conteyneth of the superficiall of the earth, because the paralell circles the neerer they bee vnto the Equinoctiall, the greater is the compasse of the earth which they make in length: and the lesser the compasse is, the nearer they be vnto the poles, as dooth appeare euidentlie by the Meridians, where they doo all concurre, and meete in the poles, their distaunces waxeth continually lesser and lesser, the neerer they bee vnto the saide poles so that the nearer the climate is vnto the pole, the lesser it containeth of myles in the length. In lyke manner shall you vnderstand that greater is the breadth of the first clime, then of the seconde, and the seconde then the thirde, and likewise of the other. For in howe much the more from the Equinoctiall you come neere to the pole, so much the more is the Sphere oblique or crooked, and consequently the day increaseth more: by reason wherof, in lesse space is founde the increasing of halfe an houre: in whiche the climate maketh difference and dooth varye. Which thing shall be more manifest to him that beholdeth the Latitude of them all, as may appeare by the Table here following: In which you may see the howres which the greatest day conteyneth of euery climate in his begynnyng, middest, and ende,

What is a climate.

Difference of dayes.

The space of seuen climats

The quantitie of the lesse circles.

The Latitude of Climates.

ende, which also the eleuation of the Pole, or distance from the Equinoctiall, and also the degrees of Latitude, which euery Climate contayneth.

The longest day.					The elenation of the pole.								Differences	
Clima.	Begin.		Midst,		End.		Beginning		Midst		End.		of the latitude	
	ho.	M	ho.	M	ho.	M	G	M	G	M	G	M	G	M
1	12	45	13	0	13	15	12	45	16	40	20	30	7	45
2	13	15	13	30	13	45	20	30	24	15	27	30	7	0
3	13	45	14	0	14	15	27	30	30	45	33	40	6	10
4	14	15	14	30	14	45	33	40	36	24	39	0	5	20
5	14	45	15	0	15	15	39	0	41	20	43	30	4	30
6	15	15	15	30	15	45	43	30	45	24	47	15	3	45
7	15	45	16	0	16	15	47	15	48	40	50	30	3	15
8	16	15	16	30	16	45	50	30	51	58	53	17	2	47
9	16	45	17	0	17	15	53	17	54	29	55	34	2	17

Dia Meroe.

The fyrst Climate, is called Dia Meroes: Meroe is a Citie of Affricke, vnder the burt Zone, on this side the Equinoctiall, 16. degrees.

Dia Siena

The second, is called Dia Siena: Siena is a Citie in the confines of Ethiope, where there is a well that sheweth the Sommer solstitiall, because that place is vnder the circle of the Tropike of Cancer, and the Sunne seemeth to stande directly ouer that place at mydday of the solsticiall, whereby the well is then very cleere, and hath in it no shadowe at all: as the Poet Lucan maketh mention in Farsalia, where he sayth:

Vmbras nusquam flectentes.

That is to say, Shadowes no where reflecting.

Dia Alexandros.

The thyrde is Dia Alexandros Alexandria is a famous Cittie in Affricke, builded by great Alexander, and is the chiefe Citie or Metropolis of Egipt.

Dia Rhodos.

The fourth is Dia Rhodos: Rodes is an Ilande of Asia the lesse, where were sometymes the Knightes of the Rhodes, called the Knyghtes of the order of Saint John, or Knyghtes of Hierusalem, who were dryuen from thence, when the Ilande and Cyttie was taken by Solton Sulimon the great Turke, in the yeare. 1522 Philippo Vrlerio Frencheman,

Knightes of the Rhodes. The Rhodes taken by the Turke.

man, being then graunde Maister of the Rhodes. Within this fourth Climate is the Citie of Hierusalem, within the holy land called Palestina, and also a great part of Spayne, with many other Prouinces.

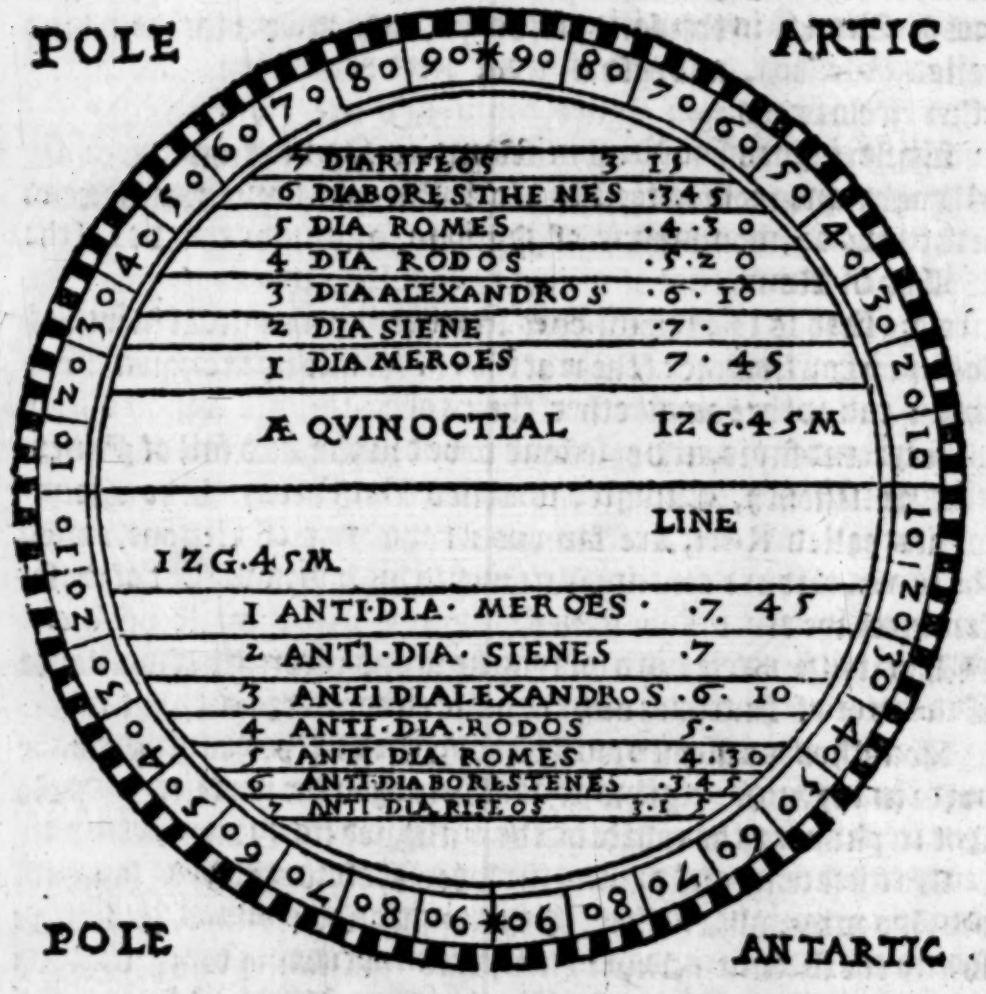
The fyfth, is Dia Romes. Rome is the most famous Citie of Italie, and most notorious of all Europe, sometime the head of the worlde, dominatrix of Nations, and now the See of the Byshop of Rome. *Dia Romes.*

The sixth, is Dia Boristhenes, Boristhenes is a great Riuer of Scithia ỳ fourth arme of the riuer Istro. It falleth into ỳ sea Euxinum: and where as all other riuers of Scithia are troubled, this is cleere and fayre, also holesome to be drunke, and full of Fishes. *Dia Boristhenes.*

The seuenth, Climate, is called Dia Rifeos. The Mountaynes called Rifei, are famous in the part of Europe called Parmatia, and are continually couered with Snow. Out of these, springeth the riuer Tanais, well knowne in the world by fame. When it is written with ph it is the name of certain Mountains of Archadia. And here ought we not to be ignorant, that wheras the authours assigned onely seauen Climates, they might haue made many more. And for that they iudged the parte of the Pole Antartyke not to be inhabited, they assigned no Climates thereto. *Dia Rifeos* The riuer Tanais.

To these seauen Climes, the later Cosmographers, haue added two more, which they call the eyght and the ninth, beginning where the seauenth Clime ends, and continuing to 55 degrees 34'. of Latitude, the eyght clime passing thorow Meotis, and the ninth thorow Denmark. Both which Climes are heereunto added with the length of the longest day, and the eleuation of the Pole, both at the beginning, middest, and end of the said Climes. In like maner describing Meridionall or South Climates, wee call them by the selfe same names, as we did the afore said Septẽtrionall, or North Climates: sauing that it is necessarie to put before euery of them this Greke proposition Anti, which in the Latine tongne signifieth Contra, or Contrarium (that is) contrary or against. So that as we named ỳ first North Climate Dia Meroes, we must to the first of the South, adde this word Anti, and so shal the first South Climate be named Anti Dia Meroes: The setonde, Anti Dia Sienes, and so forth of the other, as is seene in the figure heere following. The Meridian or South Climate.

The



The.xx. Chapter of certeyne principles, that ought to be knowne for this science.

IN treating of the Sphere, wee haue spoken of Circles, Circumferences, Centers, Diameters, Lynes, with suche other wordes, appropriat to this science: The which, what they are, it is conuenient further to declare.

A right line. A right lyne, is a shoort extention from point to poynt.

An angle. An angle, is the touching of lynes in one superficiall, whose

whose touch shall not be direct: for if it be, it shalbe a lyne, and not an angle. Solide is a bodye, which by diuisions hath length, breadth, and depth. Solide.

A circle is a playne figure, contayned vnder a line drawne in compasse, in whose middest is a poynt or pricke, from the which all ryght lynes comming foorth to the circular lyne that compasseth it about, are equall. A circle.

The circumference of a circle, is a lyne that conteyneth the circle, (that is to meane) that lyne to the which all right lines that proceed from the center of the circle vnto it, are equall: and this is called the roundnesse of the circle. The circumference of a circle.

The center of a circle, is that poynt or pricke from the which all ryght lines proceeding vnto the circumference, are equal. The center of a circle.

The Diameter of a circle, is a ryght lyne which passing by the center of the circle, and extendyng his endes to the circumference deuideth it in two halfes. *Diameter,*

The halfe circle, is a playne figure, contained betweene the Diameter of the circle, and the halfe circumference. *Semicircle*

Zenith, is a a poynt or pricke imagined in the heauen, directly ouer the toppe of any thing, as if wee shoulde imagine a ryght lyne to passe by the center of the earth, extended from thence directly to heauen, and passing through the feete and head of a man standyng vpright, so that the extremities or endes of this lyne, should reach vnto and touch the circumference of heauen: then the imagined poynte or pricke of heauen, where the ende of the lyne toucheth, is called Zenith, or point of the head, or verticall poynt. The same is to bee vnderstood of a cittie, or any other thing, when we speake of the Zenith thereof. *Zenith.*

Eccentricke, is a circle, which hath his center distant, or diuided from the center of the worlde, and is described in the heauen of the Sunne, imagining a lyne from the center of the Eccentricke, to the center of the Sunne, making a compleat reuolution at the proper motion of the Sunne, in the other heauens, imagining a lyne from the center of his Eccentricke, to the center of his Epicicle, and beeing mooued a whole reuolution at the proper motion of the Epicicle. *Eccentrik,*

The

Epicicle. The Epicicle, is a circle, or little rundell fyxt in the depth of the Eccentricke: in which the Planet fixed, and neere to his center, is mooued circularly.

Auge. The Auge, is a poynte in the circumference of the Eccentricke, neereſt vnto the firmament: or it may be ſayd, that the Auge is a poynt fardeſt diſtaunt from the earth. Aux in the Greeke tongue is as much to ſay, as the greateſt longitude, or greateſt eleuation from the earth. The Oppoſite of Auge, is an other poynt in the circumference of the Eccentricke, neareſt vnto the earth, and fardeſt diſtant from the firmament.

Oppoſite of Auge.

¶ Here endeth the firſt part.

The ſeconde part, intreating of the *Motions of the Sunne, and the* Moone, and of the effectes cauſed thereby.

The firſt Chapter, of the courſe of the Sunne in the Zodiacke, and the effectes cauſed by the ſame.

The Sunne is the guide in Nauigation.

VV

I haue briefely ſpoken of the Sunne and of the other heauens. But for as muche as the Sunne muſt bee our marke, guyde, and gouernor in Nauigation, whereof we intend to gyue perfect inſtructions, it ſhall be neceſſarye eſpecially, and preciſely, to declare the courſe and motions thereof. Therefore (as wee haue ſayde) the Sunne is mooued vnder the Zodiacke, and vpon his Poles in the lyne Eclipticke, paſſing by the xii. ſignes, beginning in the fyrſt degree of Aries, where he maketh

The mooning of the Sunne vnder the Zodiacke.

keth Equinor, that is to say, hee maketh the day equall vnto the night in all places. Then from Aries, he entreth and moueth into Taurus, approching neerer and neerer vnto vs on the North part, whereby the length of the dayes are increased with vs, and the nights are shortened. Then entreth he into Gemini, and from Gemini into Cancer, where in the beginning of the first degree he maketh Solstice, and toucheth the Sommer or Estiuall Tropike, and then are the dayes longest with vs, and the nightes shortest. Then declineth he no farther from the Equinoctiall: but returning towarde it, passeth by this signe, shortenyng the dayes to vs, and lengthenyng the nyghtes. From this signe of Cancer, it entreth into Leo, and passeth by it into Virgo, and by it entreth into the first degree of Libra, where he is in the Equinoctiall, and then he maketh the other Equinor, so that the night is then equall vnto the day ouer all the worlde. And passing by this signe, goeth declining from the Equinoctiall towarde the pole Antartike, increasing the nightes to vs, and shortening the dayes: and so entreth into Scorpio, and from thence into Sagittarius. And passing by it, entreth into the first degree of Capricorne, to the Hiemall or Winter Tropike: and then are the longest nightes vnto vs, and the shortest dayes. From hence he returneth towarde the Equinoctiall, shortening vnto vs the nightes, and lengthening the dayes. He passeth by this signe of Capricorne, and entreth into Aquarius: and passing by it, entreth into Pisces: and passing from thence, returneth to his first poynt of the Equinoctiall of Aries, where he began. Hereby it followeth, that as the Sunne goeth the halfe of the zodiacke on this parte of the Equinoctiall, and the other halfe on the other part of it, and in these halfes hath diuers declinations, is caused the increasing or decreasing of the dayes and nightes, to one more, and to another lesse, according as euery one with his Horizon discouereth of the course of the Sunne, by the litle or much that he is departed or distant from the Equinoctiall, or as the pole is raysed aboue his Horizon. So that when as to them that are on this part of the Equinoctiall, is the longest day and the shortest night: euen so to them

The Sommer Tropike.

Declinatiõ of the Sunne.

The Winter Tropike.

The cause of increasing & decreasing of the day and nightes.

on the other part, is the longest night, and shortest day. And contrarywise, when vnto vs is the shortest day, vnto them is the longest, which shall further appeare by euident demonstration in the last Chapter of the thirde part.

The moouing of the Sunne in the center of his Sphere

The discreete Reader shall here note, that the Sunne is not mooued regularly in the Zodiacke, making so much by his proper motion in one day, as in the other, because his reguler motion, is in respect of the center of his owne proper sphere or orbe wherein he is mooued, whose center is distaunt without the center of the worlde, toward that part of Cancer, so that the greater part of his orbe eccentricke, is towarde the septentrionall part, where the Sunne passing by the septentrioall signes, is more distaunt from the earth, and hath more to goe of his orbe eccentricke, then being in the South signes: for passing by the North signes, he tarrieth nine dayes more, to describe that halfe of the Zodiacke, then the other halfe towarde the South part, and for that cause the Sunne is more swifter in his motion in the Zodiacke one tyme then another, for his motion in one day, in the South signes, shalbe greater then it is in one day in the North signes as shall appeare in the table that followeth: whose vse is, for the finding of the motion and true place of the Sunne in the Zodiacke for euery day of the yeare. And hereby it followeth of the sayde vnequall moouing of the Sunne, and by the obliquite of the Zodiacke, certaine dayes of Winter, with their nightes, are longer then certaine other of Sommer, with their nyghtes: that is to say, that the day naturall in the Winter, doth surmount that in the Sommer, because the right assension, which aunswererh to one dayes motion of the Sunne, being in the South signes, is greater then the assension for one dayes moouing, being in the North signes.

The

The .ii. Chapter, of the true place of the Sunne. in the Zodiacke.

THe true place of the Sunne, is a poynt or pricke in the Zodiacke, whiche is thus founde: that drawing a ryght lyne from the center of the worlde, to the center of the Sunne, and carrying the same continually right forth vnto the Zodiacke, where this lyne sheweth or toucheth, that is the true place of the Sunne. This place is found in three maners. One way, by a table: another way, by an instrument: and the thyrde way, by a certaine rule, to be borne in memorie. To finde the true place of the Sunne by a table, seeke in the table following, the month that you are in, in the front or head of the table, and the dayes of the moneth, on the left syde of the table. Then directly against the dayes, vnder the title of the monethes, you shall finde two numbers, which are the degrees and minutes of the signe which you shall first finde named ouer the head, or aboue the sayde numbers. Then to the degrees and minutes which you shall finde, you shal adde the equation, that is directly of the yeere in the which you are, or seeke to knowe. And this shall you seeke in the table of equations, which is after this: and that which doth amount or rise thereof, shalbe the true place of the Sunne. And here is to be noted, that in the common yeeres (which are they that haue not the bisextile or leape yeeres) from the ende of February vntill the ende of the yeere (I say of December) shall euer one degree be diminished or taken away: and the degrees and minutes that shall remaine, is the true place of the Sunne. How to know this by an instrument and by memorie, shalbe sayde in the seuenth Chapter.

To finde the true place of the Sunne.

The equation of the yeere.

The

The Table of the true place of the Sunne.

month	January		Febrna		Marche.		Aprill.		May.		June.	
Signs	Caprico		Aquari.		Pisces.		Aries.		Taurus		Gemini.	
Days	☉	☽	☉	☽	☉	☽	☉	☽	☉	☽	☉	☽
1	20	22	21	53	20	55	21	24	20	21	19	55
2	21	24	22	54	21	55	22	22	21	18	20	52
3	22	25	23	54	22	54	23	21	22	16	21	49
4	23	26	24	55	23	54	24	19	23	11	22	46
5	24	27	25	55	24	53	25	17	24	13	23	43
6	25	28	26	56	25	53	26	16	25	8	24	40
7	26	30	27	56	26	52	27	14	26	5	25	37
8	27	31	28	56	27	52	28	12	27	3	26	34
9	28	32	29	57	28	51	20	10	28	☽	27	31
10	29	33	☉♓	57	29	59	☉♉	8	28	58	28	28
11	☉♏	35	1	57	☉♈	49	1	6	29	55	29	25
12	1	36	2	58	1	48	2	4	☉♊	52	☉♋	22
13	2	37	3	58	2	47	3	2	1	50	1	19
14	3	38	4	58	3	46	4	0	2	47	2	16
15	4	39	5	58	4	45	4	58	3	44	3	13
16	5	40	6	58	5	44	5	56	4	41	4	10
17	6	41	7	58	6	43	6	54	5	38	5	7
18	7	42	8	58	7	42	7	52	6	36	6	4
19	8	43	9	58	8	41	8	49	7	53	7	1
20	9	44	10	58	9	39	9	47	8	30	7	58
21	10	45	11	58	10	38	10	45	9	27	8	55
22	11	46	12	58	11	37	11	43	10	24	9	52
23	12	47	13	57	12	36	12	40	11	21	10	49
24	13	48	14	57	13	34	13	38	12	18	11	46
25	14	48	15	57	14	33	14	36	13	15	12	43
26	15	49	16	56	15	32	15	33	14	12	13	40
27	16	50	17	56	16	30	16	31	15	10	14	37
28	17	51	18	56	17	29	17	28	16	7	15	34
29	18	51	19	56	18	28	18	26	17	4	16	31
30	19	52			19	27	19	23	18	1	17	29
31	20	52			20	25			18	58		

The Table of the true place of the Sunne.

month	July		August		Septēber		Octōber		Nouēber		Decēber	
Signs	Cancer.		Leo.		Virgo.		Libra.		Sco pio		sagittar.	
Degrs.	☉	☽	☉	☽	☉	☽	☉	☽	☉	☽	☉	☽
1	18	26	18	2	18	4	17	39	18	49	19	24
2	19	23	19	0	19	2	18	39	19	50	20	26
3	20	20	19	58	20	1	19	38	20	51	21	27
4	21	17	20	55	21	0	20	38	21	52	22	29
5	22	14	21	53	21	58	21	38	22	53	23	30
6	23	11	22	51	22	57	22	38	23	54	24	31
7	24	8	23	48	23	56	23	38	24	55	25	33
8	25	5	24	46	24	55	24	38	25	56	26	34
9	26	2	25	44	25	54	25	39	26	57	27	36
10	27	0	26	42	26	53	26	39	27	58	28	37
11	27	57	27	40	27	52	27	39	28	59	29	39
12	28	54	28	38	28	51	28	39	☉♃	0	☉♑	40
13	29	51	29	36	29	50	29	39	1	1	1	42
14	☉♌	48	☉♍	34	☉♎	49	☉♏	39	2	3	2	43
15	1	46	1	32	1	48	1	40	3	4	3	45
16	2	43	2	30	2	47	2	40	4	5	4	46
17	3	40	3	28	3	46	3	40	5	6	5	48
18	4	38	4	26	4	45	4	41	6	8	6	49
19	5	35	5	24	5	45	5	41	7	9	7	51
20	6	32	6	22	6	44	6	42	8	10	8	52
21	7	30	7	21	7	44	7	42	9	11	9	54
22	8	27	8	19	8	43	8	43	10	12	10	55
23	9	25	9	17	9	42	9	43	11	13	11	57
24	10	22	10	16	10	42	10	44	12	14	12	58
25	11	20	11	14	11	41	11	45	13	15	13	59
26	12	17	12	13	12	41	12	45	14	16	15	1
27	13	15	13	11	13	41	13	46	15	18	16	2
28	14	12	14	10	14	40	14	47	16	19	17	3
29	15	10	15	8	15	40	15	47	17	20	18	5
30	16	7	16	7	16	39	16	48	18	22	19	6
31	17	5	17	5			17	49		23	20	7

The Table of the Equation of the Sunne.

The yeres of our lord	The equatiō to be added.		The yeres of our lord	The equatiō to be added.		The yeres of our lord	The equatiō to be added		The yeres of our lord	The quatiō to be added.	
	G	M		G	M		G	M		G	M
1545	K1	0	1581	1	16	1617	1	32	1653	1	48
1546		45	1582	1	1	1618	1	17	1654	1	33
1547		30	1583		46	1619	1	2	1655	1	18
1548		15	1584		32	1620		47	1656	1	3
1549	1	2	1585	1	18	1621	1	33	1657	1	49
1550		47	1586	1	3	1622	1	18	1658	1	34
1551		32	1587		48	1623	1	3	1659	1	19
1552		18	1588		33	1624		49	1660	1	4
1553	1	4	1589	1	19	1625	1	35	1661	1	51
1554		49	1590	1	4	1626	1	20	1662	1	36
1555		34	1591		49	1627	1	25	1663	1	21
1556		13	1592		35	1628		51	1664	1	7
1557	1	05	1593	1	21	1629	1	37	1665	1	53
1558		50	1594	1	6	1630	1	22	1666	1	38
1559		35	1595		51	1631	1	7	1667	1	23
1560		21	1596		37	1632		53	1668	1	9
1561	1	7	1597	1	23	1633	1	38	1669	1	55
1562		52	1598	1	8	1634	1	23	1670	1	40
1563		37	1599		53	1635	1	8	1671	1	25
1564		23	1600		39	1636		54	1672	1	10
1565	1	9	1601	1	25	1637	1	40	1673	1	56
1566		54	1602	1	10	1638	1	5	1674	1	41
1367		39	1603		55	1639	1	10	1675	1	26
1568		25	1604		40	1640		56	1676	1	12
1569	1	11	1605	1	26	1641	1	42	1677	1	58
1570		56	1606	1	11	1642	1	27	1678	1	23
1571		41	1607		56	1643	1	12	1679	1	28
1572		26	1608		32	1644		8	1680	1	13
1573	1	12	1609	1	28	1645	1	44	1681	K2	☉
1574		57	1610	1	13	1646	1	29	1682	1	45
1575		42	1611		58	1647	1	14	1683	1	30
1576		28	1612		44	1648	1	0	1684	1	15
1577	1	14	1613	1	30	1649	1	46	1685	1	2
1578		59	1614	1	15	1650	1	31	1686	1	4
1579		44	1615	1	10	1651	1	16	1687	1	32
1580		29	1616		46	1652	1	2	1688	1	8

This Table of the Equation of the Sunne, serueth from the yeere of. 1545. where it hath his roote or beginning, vntil. 1680 and in the yeere of 1681. shall returne to the roote, addyng therevnto one degree more. As for example. In ỳ yeare of. 1681 adde one degree vpon the other degree that the roote hath, and so shal the yere of. 1681. haue two degrees of Eqnation and the yeere of. 1682. shall haue one degree, ℈. 45. minutes, which is to adde one degree vpon 45. minuts, that had the yere of. 1546. &c. And hauing passed other. 136. yeeres, you shall returne to the root, adding two degrees.

The. iii. Chapter of the declination of the Sunne.

THE declination of the Sunne, is the arke of the greater Circle, whyche passeth by the Poles of the worlde, included betweene the Equinoctiall, and the Zodiacke. And heere is to bee noted, that whatsoeuer foure poyntes or pryckes which are equally distaunt from the poyntes of equinoxes (which are the beginnings of Aries and Libra) shall haue equall declinations. What is the declination of the Sunne.

Whereof it followeth, that the foure quarters of the Zodiack haue equall declinations. And to auoyde proliritie, I will adde hereunto a Table of the declinations of onely one quarter of the Zodiack, so that al hauing one selfe same maner of declinations, it may serue for all, and the order of it is this. The signes whose declination increaseth, are in the head or front of the Table, and the degrees of these signes descend by the left side thereof. And the signes whose declination decreaseth, are in the foote of the table, and the degrees of these signes, rise by the right side of the same. The disposition of the table being vnderstoode: then to knowe what declination the Sunne hath in euery degree of the Zodiake, you ought to know the true place of the Sunne (as in the

Signes	♈	♎	♉	♍	♊	♐	Signes
☉	☉	☽	☉	☽	☉	☽	☉
0	0		11	30	20	12	30
1	0	14	11	51	20	25	29
2	0	48	12	12	20	37	28
3	1	12	12	33	20	49	27
4	1	36	12	53	21	0	26
5	2	0	13	13	21	11	25
6	2	23	13	33	21	22	24
7	2	47	13	53	21	32	23
8	3	11	14	13	21	42	22
9	3	35	14	32	21	51	21
10	3	58	14	51	22	0	20
11	4	22	15	10	22	9	19
12	4	45	15	28	22	17	18
13	5	9	15	47	22	25	17
14	5	32	16	5	22	32	16
15	5	55	16	23	22	39	15
16	6	19	16	40	22	46	14
17	6	42	16	57	22	22	13
18	7	5	17	14	23	57	12
19	7	28	17	31	23	3	11
20	7	50	17	47	23	8	10
21	8	13	18	3	23	12	9
22	8	35	18	19	23	15	8
23	8	58	18	34	23	19	7
24	9	20	18	49	23	22	6
25	9	42	19	4	23	24	5
26	10	4	19	18	23	26	4
27	10	26	19	32	23	28	3
28	10	47	19	46	23	29	2
29	11	9	19	59	23	30	1
30	11	30	20	12	23	30	0
Signes	♓	♍	♏	♑	♌	♋	Signes

Chapter passe is declared) for the day of the declynation which you desire to knowe, and the signe whiche the Sunne shall bee found in that daye, shall you seeke in the fronte or foote of the Table. And if it be in the fronte, you shall seeke the number of the degrees on the left side. And if it shall be at the foote of the table, you shall seeke it on the right side. Then aboue or vnder ☿ signe, in the front of that degree of the saide signe, you shall fynde two numbers, whereof the first is of degrees, and the second of minutes: and those degrees and minutes of declination the Sun hath that day: Suppose ☿ place of the Sun were the 24 degree of ♈. the name of the signe standeth at the toppe of the table therefore I seeke out the 24 degree, on the left hande and going from thence towardes the right hand till I come right against ♈. I finde the declination to be 9 degrees. 20'.

Example.

Againe, suppose the place of the Sunne to be 20 degrees of ♌.

the

the name of the signe is at the foote of the table, therefore I seeke out the 20 degree, on the right hande, and going from thence towardes the left hande till I come right against ☊. I finde the declination to be 14 degrees. 51.'.

And this is vnderstood without hauing respect to the od minutes aboue the degree, which the true place of the Sunne hath.

But if you desire to verifye this more precisely, note the declination of that degree, and of the degree following: and take the lesse from the more, and that which remayneth, shalbe the difference of the declination from the one degree to the other, of which difference ye shall take a part proportionally, as are the minutes of the place of the Sun vnto. 60. And this part of minutes must be added to the firste declination of it, if the declination increase or must be taken from it, if it decrease, and then that riseth thereof, shalbe the precise declination for that signe, degree, and minute.

As for example the 6 of July 1596. I finde the place of the Sunne to be in 23. degrees .48'. of 69 and to 23 degrees aunsweres 21 degrees, 32.'. of declination, and the declination of 24. degrees, is 21 degrees. 22.'. the difference is 10.'. then I say by the rule of 3 if 60.'. which is one degree, giue 10.'. which is the difference of one degrees declination, what giueth 48.'. which are the od minutes of the place of the Sunne and the quotient shewes 8.'. which because the declination decreaseth, I substract from 21 degrees, 32.'. the declination of 23 degrees iust, and there resteth 21 degrees, 24.'. for the declination of the Sun being in 23 degrees 48.'. of 69.

Againe this present yeere 1596 the 8 of November the Sun is in 26 degrees, 33.'. of ♏. to 26 degrees of. ♏. aunsweres 19 degrees 18'. of declination: and to 27 degrees aunswers 19 degrees 32.'. of declination: the difference is 14.'. then I say if 60 giue 14. what giues 33? the quotient is 7. which because the declination doth increase, I adde to 19 degrees 18.'. it makes 19 degrees 25.'. which is the declination of the day proposed.

The-

The. iiii. Chapter of the increaſe of the Sunne into the twelue Signes, And of the Equinoctials and Solſtitialls which deuide the foure times of the yeere.

The entrance of the Sunne into the foure principall ſignes.

IF that it is ſayd in the Chapter before, it foloweth that the ſunne entring into the foure principall ſignes, cauſeth the foure times of the yere. For entring into Aries, it changeth the time to vs from winter to the ſpring time. And entring into Cancer, it changeth the time from ſpring to ſommer. And entring into Libra, from ſommer to Autumme. Likewiſe entring into Capricorne, it chaungeth from Autumne to Winter. So that when to vs that bee on the parte of the North, is ſommer, then is it winter to them that are on the South part. Or contrariwiſe being ſommer to them on the South, it is winter to them on the North. The entrance of the ſunne into theſe ſignes, and all other of the Zodiack hath not been euer at one ſelf ſame time of the yere. The cauſe of this is, that the Latine yere is not equall with the mooving of the ſunne in the Zodiacke, as ſhalbe ſayd in the .x. Chapter, where we wil entreate of the yere. In the time that Chriſt our redeemer was borne, were the Equinoctiallcs, The one at the eyght of the kalendes of Aprill, and the other at fyue of the kalendes of October: So that they had the Equinoctiall of the Spring, at the .xvi. of Marche, and the Equinoctiall of Autumne, at the xxvii. of September, as writeth John Baptiſt Capuano vpon the ſeconde Chapter of the ſphere of Iohan. De ſacro boſco. They iudged then the Solſticialles, as that of the Sommer, at the eyght day of the kalendes of July, which is the xxiiii. of June: the other of the Winter, they iudged at the eyght day of the kalendes of Januarie, which is the .xv. of December. And heere will I not omit

The Latine yeere, the Equinoctialles in the yere of Chriſtes birth.

The Solſtitials.

to

to say how in those times, at these foure dayes (that is to meane, in the two Solstitialles and two Equinoctialles) were celebrated, or did chaunce foure maruellous thinges in the worlde. For in the spring Equinoctiall, which was at the .xxv. of March, the Sonne of GOD was incarnate, and afterwarde borne of the Virgin Marie in the Solstitiall of Winter, whiche was at the .xxv. of December. In the Equinoctiall of Autumne, whiche was the .xxvii. of September, was conceiued blessed John Baptist, the cryer and precursour of Christe: and was borne in the sommer Solstitiall, that was the .xxiiii. of June. And this is the sixth Moneth whereof Saint Luke speaketh in the Gospell. Whiche thyng also John Chrisostome doth verifye, saying that Saint John was borne when the dayes beganne to decrease, and our Lorde when they began to increase. And it may certeynely seeme worthy to be had in memorie, that in the sayde Equinoctiall of the spring, Christe suffered, Adam was created and lost the estate of innocencie, Abell was slayne, Melchisedech offered bread and wyne, Isaac by Abraham was brought to be sacrificed, John Baptist was beheaded at Macherunta, Peter deliuered out of Prison, Saint James beheaded by Herode, the good Theefe enioyed Paradise, and the bodies of many Saints rose with Christe. And who so further desyreth more precisely to knowe the entraunce of the Sunne into Aries, and into the other principall signes, shall in the thyrde parte of this woorke in the eight Chapter, fynde rules whiche shall bring him to the knowledge thereof.

Foure notable thinges.

To know more precisely the entraunce of the Sunne into the foure principall signes.

thereof. But to returne to our time, I say this present yeere of 1596. being leape yeere, the Sunne entreth into the Equinoctiall of ♈. the tenth of March at a 11 of the clock at night: into the first degree of ♉. the tenth of Aprill at one of the clock in the morning: into ♊. the 12 of May, at three howers after noone: into ♋, the 12 of June, sixe howers after noone: into ♌. the 13 of July nine howers: into ♍. the 13 of August, at 2 in the morning: into ♎. the 13 of September, at one in the morning: into ♏. the 13 of October, at one in the morning: into ♐. the 12 of November before one in the morning: into ♑. the 12 of December at three in the morning: into ♒. the 10 of January, fiue howers after noone: into ♓ the 9 of February, at 8 hours after noone.

And for to knowe the certaine time of the Sunnes entraunce into each signe, for any yeere hereafter, you must adde for euery yeare fiue howers, and 49 minutes, which is the ouerplus that each yeere hath, so that in foure yeeres it comes to one naturall day. Which is added to February, making it thereby to haue 29 dayes, which in other yeeres hath but 28, and then pulling one day back againe from the yeere 1596. and to that which remaineth, adde to the yeere 1597. 5 howers, 49 mynutes, and as much more euery yeere following, which shalbe a certaine rule for euer.

Nowe you must note that the degrees and minutes, whiche are heere noted, are properly for the Cittye of London whose longitudes is 25 degrees. 50.′. and if you desire to applie them for places more Eastwarde, then for euery 15 degrees difference

difference in longitude, you muſt adde owne howre, and if for places more Weſtward for euery 15. degrees difference of longitude you muſt ſubſtract one howre, by reaſon of the Sunnes rapt mouing from the Eaſt to the Weſt, for it is certeyne that when with vs in London it is twelue of the clocke, to them of Meiſſen which is 15. degrees to the Eaſtwards of vs, it is one of the clocke: and to them of Forteuentura, which are 15. degrees to the Weſt of vs it is but a eleuen of the clocke.

Variation of houres by the rapte moouing of the Sunne from the Eaſt to the Weſt

Now that we haue Rules to knowe the entraunce of the Sunne into the xii. ſignes, thereby may we alſo knowe hys entraunce into the foure Cardinall or principall ſignes, which are they that determine and ende the Equinoctialles and Solſtitialles, whereby are cauſed the foure times of the yeere. And for as much as the generall chaunge of times, is by reaſon of the Sunne, who by his comming neere, warmeth, by his remayning, dryeth: with his departure: cooleth, and by his long tarying away, cauſeth moyſtneſſe: we will ſhew the qualities of the principall windes, elements, regions, humours, and ages, in one briefe Table: and then conſequentlie in an other will we deſcribe the beginning, myddeſt, and ende of the foure times of the yeere, aſwell in the monethes, as in the heauenly ſignes.

The entrance of the Sunne into the iiii. principall ſignes, cauſeth the chaunge of time.

The Table of the qualities of the Elementes.

Qualities.	Hot & dry	Hot & moiſt	Cold & moiſt	Cold & dry
Partes of the yere	Sommer	Spryng.	Winter.	Autumme
Principal windes	Eaſt.	South.	Weſt.	North.
Elements.	Fyre.	Ayre.	Water.	Earth.
Regions.	Eaſt.	South.	Weſt.	North.
4. Humours.	Choler.	Blood.	Flegme.	melãcholy
4. Ages.	Youth	Mans ſtate	Aged.	Age.

The

The Table of the foure times of the yeere.

Times.	beginning.	Middest.	Ende.
Spring.	Marche. Aries.	April. Taurus.	May. Gemini.
Sommer.	June. Cancer.	July. Leo.	August Virgo.
Autume.	Septemb Libra.	Octob. Scorpio	Nouemb. Gemini.
Winter.	Decemb. Capric.	Janu. Aquar.	Februa. Pisces.

The v. Chapter, of the Moone, and of her motions and properties.

The Sunne & Moone are the principal luminaries.

IN the Chapters passe of this seconde parte, wee haue entreated of the Sunne, and of his motions and effects, as the most noble and principall luminary. In this present Chapter we wil entreat of the Moone, which is the second luminarie, although in the order of the heauens she is the first, and nearest vnto vs of al other Planets or starres. The Moone therfore is a round body, of heauenly substaunce solide and darke in respect of the Sunne, hauing no proper light of hir owne, but is apt to receiue light. She is mooued from the West in to the East, according to the order of the Signes, euery day 13. degrées little more or lesse, and somewhat more then 10. minutes, by the proper motion of the heauen or Sphere vpon the Axes and Poles of the Zodiacke. I say more or lesse, because that ouer and beside the mooving of her deferent or circle, which is mooued euery day the aforesayde 13. degrées & 10. minutes, almost 11. she hath an Eclipse where the Moone is fixed: at the motion whereof, sometimes she is moued more swiftly, & sometimes more slowly: Neuertheless, according to her selfe motion, shee maketh her course in 27. dayes & almost 8. houres: and hauing no light of her owne, she is lightened of the Sunne, as manifestly apeareth heereby, that being in coniunction with the Sunne, or neere vnto him, wee see her not lightened: because the lyght which shee then receiueth, is onelie her vppermost or highest parte, wherby shee directly beholdeth the Sunne, forasmuch as hee is

The Ecclipse of the Moone.

The coniunction of the Moone with the Sunne.

The Moone receiueth her light of the Sunne.

in

inthe fourth heauen, and she in the first. And departing from the Sunne by her proper mouing, the Sunne remaineth on the West part. Then towarde that parte we begin to see a litle of thepart of the Moone lyghtened, and so more and more by lytle and litle, as she departeth farther from the Sunne. And at this tyme she hath her hornes or corners towarde the East, because the Sunne is in the West. During this time also, she is sayd to increase, or that she goeth increasing vnto the opposition which we see, by the parte of her, which the Sunne directly beholdeth. And so do wee see her altogeather lightened, and call it the full Moone. Then passing from the opposition, she commeth nearer the Sunne by litle and litle, being darkened and hyd from vs and lyghtened onely by her highest parte: and this time is called the decreasing or wane of the Moone. Then also hath she her hornes towarde the West, because the Sunne is in the East: and this vntyll shee turne againe in coniunction with the Sunne, and that we see her not lightened at all.

The aspect of the moone to the sunne.

The encreasing & opposition of the Moone.

The Moone is lesse then the starres or other planets, except Mercurie, and lesse then the earth. And if any shall affirme the contrary, saying that it is written in the fyrst of Genesis, that God made two great lyghtes: the greatest to giue light to the day, and the lesse to lighten the night (as Dauid also affirmeth.) To this I aunswere, that the Moone being nearest vnto the earth, appeareth vnto vs greater then she should bee, if she were further distaunt from vs. And although she be great of lyght (receyued as we haue sayd) & bygge of body, yet is shee not great in respect of the other starres. And therefore the wordes of Genesis aforesayd, may be vnderstoode to be spoken in such maner and phrase as holy scripture often vseth, to humble and applye it selfe to the weakenesse of our vnderstanding, and groseneſſe of our senses.

The bignes of the moone.

The moone is neerest vnto the earth.

The. vi. Chapter of the coniunctions and oppositions of the Sunne and the Moone.

The

The motion of the moone.

THe Sunne and the Moone are mooued vnder the Zodiacke with diuers motions. The Moone with a swifter motion then the Sunne followeth him, ouertaketh him, and goeth before him, vntil she placeher self in Diameter with him And when shee hath thus ouertaken him, so that they are both in one self same degrée of the Zodiacke, then is the coniunction.

The coniunction.

Then departing from him, and being in equall degrees of the signes opposite according to the Diameter, is the oppositon.

The opposite.

To know the times of oppositions and coniunctions, &c.

To knowe the tyme of these coniunctions and oppositions is very profitable and necessarie for Mariners. These times may be knowen in two maners. One way, by the Ephimeridies or Almanacke, or other tables, or Lunarie instrumentes. And by these meanes is knowen precisely the day, houre and minute of the coniunction and opposition. It may likewyse bee knowen by the rules of computation, whiche are the rules that are knowen by memorie, although not precisely, as by the bookes afore said. And here is to be vnderstoode, that from one coniunction to another, according to the halfe moouinges of the Sunne and the Moone, there passeth 29. dayes, twelue houres and 44. minutes. And consequently from coniunction to opposition, and from opposition to coniunction the halfe thereof, which is foureteene dayes 18. houres, and 22. minutes. To knowe these coniunctions by rules of computation, is presupposed, to knowe the golden number, and by it, the concurrent or Epacte.

To know the golden number.

The golden number, is the number of nieneténe yeares. In which tyme, the coniunctions of the Sunne and the Moone make all their varieties in the tymes of euery yeare: so that if the coniunction were the eightéenth day of March in this yere of 1596. from this yeare in the nienteene yeares following, whiche shalbe in the yeare of 1616. the coniunction shall returne to bee at the eightéenth day of March. It was first called the golden number by the Egiptians, who firste founde the vse thereof and sent it to Rome wrytten in golden Letters. To finde

this

thisnumber, it is needefull to know his rootes, which is this. In the yeere that Christ our Lorde and redeemer was borne (whereby we make this account) the golden number was the number of one, which was the yeere of the roote or begynning: and the first yeere of the birth of Christ, was two of the golden number. So thatioyning to the yeeres of our Lorde one of the roote or beginning, and from all take away the nienteene, then the rest shalbe the golden number. And if you desire to make computation by a nearer roote, take for the roote the yeere of 1500. when nienteene was the golden number, and in the yere of. 1501. did begin one of the golden number, and so consequently euer taking away the nienteene.

The roote of the golden number.

This present yeare of 1569 wee haue one of the golden number and in the yeere of 1597. we shall haue 2

the concurrent.

The golden number being knowne, it is necessarie for this computation of the Moone to know the concurreut. The concurrent of euery yeare, is the number of the dayes passed of the coniunction of the Moone at the begynning of Marche. And these grow of the difference of the Solar yeere to the Lunar: As the Lunar yeere hath. 354. dayes and the Solar yeere. 365. so hauing euery yeere eleuen dayes of difference, which are added euery yeere vntill they come to the number of thyrtie, and passing thirtie, those that do passe are of the concurrent.

The Solar & Lunar yeres.

To finde the number of the concurrent.

The number of the concurrent of euery yeere, is founde in this maner.

And the better to beare it in memorie, you must imagine three places, and these commonly are assigned on the thumbe. As the first place at the roote of the thumbe, the seconde in the myddle ioynt thereof, and the thyrde and last, in the toppe of the thumbe. Then in the first place put tenne, in the second twentie, and in the thirde thirtie. Then by the order of these places shalbe counted the golden number: As one in the first place, two in the seconde, and three in the thirde, returning forwe to the first place. &c. vntyll the golden number of that yeere for the whiche the concurrent is sought. And the number of that place where the golden number endeth, must bee ioyned with the number of the golden number; and that dooth

amount thereof, shalbe the concurrent, so that it passe not. 30. But if it passe. 30. then that, that is more then. 10. is the concurrent of that yeere.

And here is to be noted, that the yeeres of this computation of the Moone, begin at the first day of March, and last vntil the last day of Februarie, so that this present yeere. 1596. by computation of the golden number, we haue. 1. which accounted by the said places endeth in the first, which is. 10. the same ioyned with the golden number of. 1. makes. 11. and so much is the concurrent or epact.

Epact. Likewise this number of Epacte, or concurrent, is founde in multyplying the golden number by. 11. and deuiding the samme by. 30. then that remayneth, is the Epacte or concurrent.

To know the dues or age of the Moone. The concurrent being thus knowne, then to know the dayes of the Moone, it is necessarie to know three numbers. The first, is the concurrent. The seconde, the number of the moneth in which you are, begynning at March. The thyrde, the dayes past of the same moneth. And ioyning these three numbers, if they come not to. 30. so many dayes olde is the Moone. And yf they be. 30. it is the coniunction. And if they passe. 30. they also that passe, are the age of the Moone.

This is vnderstoode in the monethes that haue. 31. dayes, for in them that haue onelie. 30 dayes, the coniunction is at the 29. day, and they that passe of. 29. are the age of the Moone. As for example, the first day of August, of the Epacte. 11. monethes from March 6. and dayes of the moneth 1. make in all. 18. and so much is the age of the Moone for the day aforesayd.

Againe the 20. of September, of the Epacte. 11. of monethes 7. and dayes of the moneth 20. makes. 38. and because that September hath but 30. dayes, we must take away 29. from. 38. so there resteth 9 dayes which are the age of the Moone, so in like manner we must giue to Februarie, 29 dayes of the Moone.

To know the day of the coniunction. It followeth, that the dayes of the Moone beeyng knowen, then vnreckonyng or disreckonyng backewarde. we finde for example. The. 20. of July the Moone hath 5. daies which taken from the. 20. remayneth 15. then the 15. day was the coniunction.

The

The day of the coniunction is lykewise knowen by ioyning the monethes (begynnyng in Marche) with the concurrent, and yf they come not to .30 then at so many dayes of that moneth as lacketh of .30. shalbe the coniunction.

Example.

In August of the monthes .6. and of the concurrent or Epacte 11 are 17. which wanteth of .30. 13. then at the 13. day was the coniunction but if it be so that they passe .30. then taking them that passe 30. from the number of dayes, which the moneth next before had, ỳ which remaineth dooth shew the day of the coniunction. As for example, the Moneth of December of the yere to come 1597. we shall haue of the Epacte 22. which added with .10. the number of monethes from March make 32. then substract 2. the ouerplus of 30. from 30. the dayes of Nouember the month next before, and there remaineth 28. Then I conclude that the .28. of Nouember 1597, the Moone shall make coniunction.

The .vii. Chapter, of the declination and vse of an Instrument, by the which is founde the place and declination of the Sunne, with the dayes and place of the Moone.

IN the seconde and thyrde Chapter, I haue giuen rules to knowe the true place of the Sunne, and his declination. In thys Chapter I wyll describe an instrument, whereby may bee knowne the declination and place of the Sunne: and knowing by the chapter past, the dayes of the Moone, shall also bee knowne her place in the Zodiacke, and howe muche of her is lightened, and what aspecte, shee hath with the Sunne. To know the place of the Moone in the Zodiack, and what aspecte she hath with the Sunne.

This Instrument is in square fourme, and hath by the sides 23. degrees and a halfe, of the which the.23. and a halfe that descende from the myddyst downewarde, is the declination of the South signes: and the other from the middest vpwarde are the declinations of the North signes. Within this quadrature is described a circle, by the circumference whereof, are the twelue signes and they? degrees, ioyned to the circumference: and further within, is the number of them, and then their names. Yet further within this, is another circle, where are the twelue moneths, with they? numbers and dayes.

The description of the Instrument.

Then to the center of this circle, are annexed two rundelles, whereof the greatest & lowest is called the rundell of the Sunne.

This hath an Inder, o? shewer, in which is poynted the Sun, and in the circumference of it are the dayes of the age of the Moone. In the other circle, in the circumference thereof, is a rounde hole, rep?esenting the Moone: directly from the whiche, is another Inder comming fo?th of the circumference of thys rundell, in which rundell are all the aspectes which the Moons maketh with the Sunne.

Hauing described the Instrument, let vs declare the vse thereof, which is this.

The vse of the Instrument to finde the true place of the Sunne.

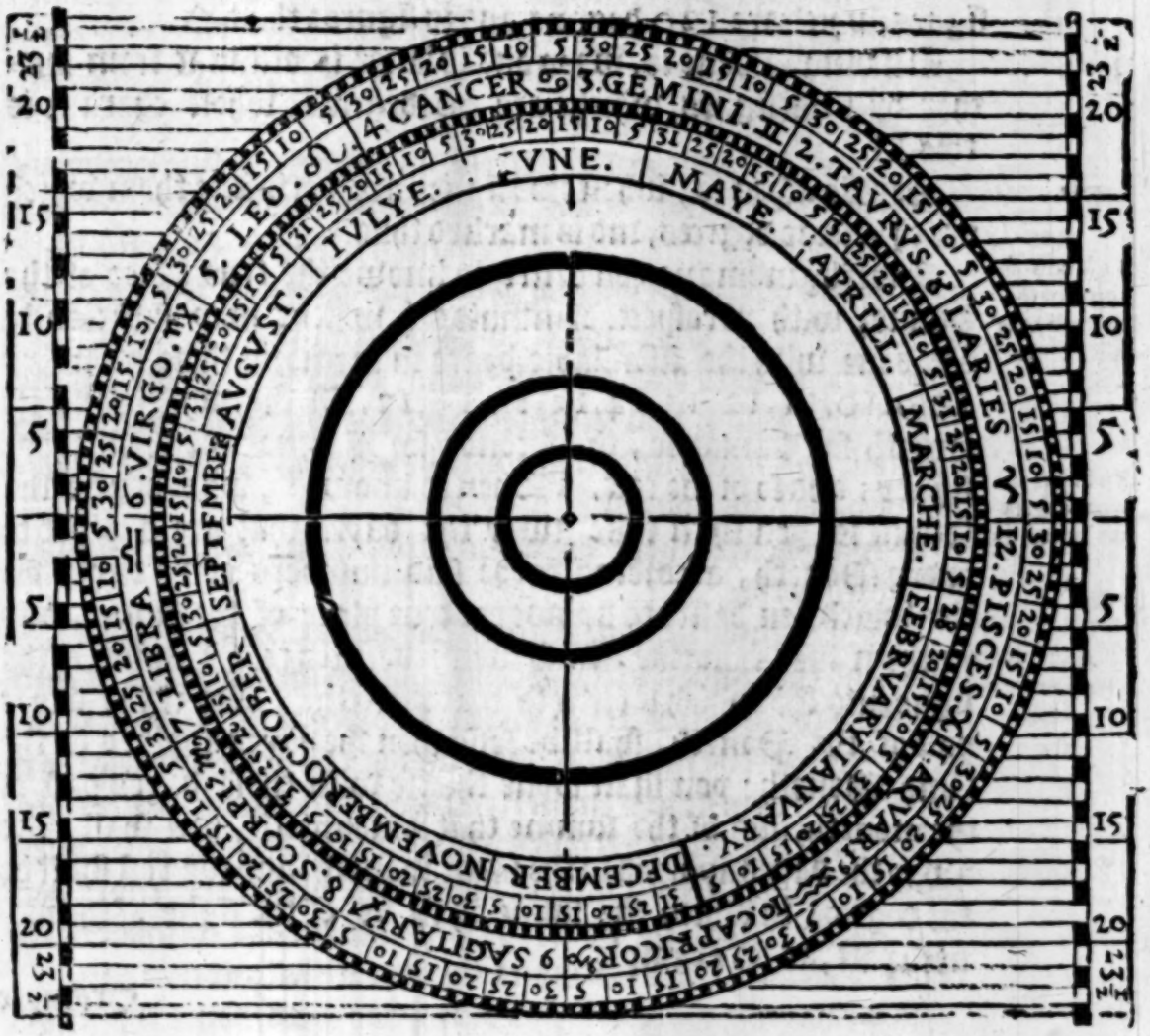
Fy?st to finde the true place of the Sunne, wee must put the Inder of the rundell of the Sunne, vppon the day of the moneth in which we are, o? desire to know the place of the Sunne Then in the circle of the signes, it shall shewe the signe and degree in the which it is: & in like maner, resting still vpon the degree, looking in the paralels that touch in the circumference, and p?oceeding by that line that toucheth the Sunne which the Inder doth note, ye shall see in the side of the Instrument the number of the degrees of the declination which the Sunne hath at that day.

To finde the place of the Moone

To finde the places of the Moone, we must holde the Inder of the rundel of the Sun, fast vpon that day of the moneth in the which we desire to knowe the place of the Moone. And accompting in the rundel of the Sunne, the dayes that haue passed from the day of the Coniunction (as I haue sayde in the Chapter be-fo?e) and where endeth that number of the dayes, if there

we

we apply the inder of the Moone, it shall shewe in the circle of the signes, the place where she is. And so shall she appeare in the instrument lightened, or darkened, more or lesse as in heauen. In lyke maner, considering the place of the Sunne and the Moone, shall be seene what aspect they haue, by the lynes that trauerse the superficiall of the Lunar circle of the Moone.



Fiue aspectes of the planets

The aspects which the Planets haue one to another, or whereby they behold one another, are fyue.

Coniunction.

Coniunction is, when two Planets bée vnder one selfe same degrée and minute in the Zodiacke, whose charact is this. ☌

Opposition.

Opposition is, when betwéene the place of the Planettes is halfe a circle, which are 180. degrées, and is thus figured. ☍

Trinall.

Trinall aspect is, when betwéene the Planettes shall be foure signes, which are 120. degrées, and is figured thus. △

Quadrine.

Quadrine aspecte is, when one Planet is distaunt from another by thrée signes, whiche are 90. degrées, whose characte is this. □.

Sextile.

Sextile aspect is, when two signes are betwéene them which are threescore degrées, and is marked thus. ⚹

To know the place of the Sunne by the rule of memorie.

And if by memorie you desire to knowe the true place of the Sunne, without respecte of minutes (whiche may sufficiently bee done with the Astrolabie, beare in memorie these numbers 10. 9. 10. 11. 12. 13. 14. 13. 14. 13. 12. Of the which the fyrst serueth for Januarie, the seconde for Februarie, with theyr signes: and so of the rest.

To know in what degree the Sunne is.

Then to knowe in what degrée the Sunne is, you shall take away the dayes that are applyed to euery Moneth, according to the said numbers of the dayes for the which you desire to knowe the true place of the sunne, and in them that remaine, in so many degrées is the sunne of the signe into the which it entreth that moneth. And if the dayes past of the Moneth, shall be lesse then the dayes applyed to the same Moneth: you shall ioyne thirtie with those dayes past of the moneth, and of the summe that amounteth, you shall take away the dayes applyed to the sayde moneth, and the rest shall be the degrées in which the sunne shall be of the signe of the moneth past, as for example.

Example

Example.

Januarie.	10 ♒	The 22. of October, taking away foure-
Februarie.	9 ♓	teene that were applyed, remaine eyght de-
Marche.	10 ♈	grées of Scorpio, where the sunne is.
Aprill.	10 ♉	*Another Example.*
May.	11 ♊	The syre of December, whiche are lesser
June.	12 ♋	then twelue which is applyed vnto it, if
July.	13 ♌	wée ioyne syre to thyrtie, whiche are the
August.	14 ♍	dayes of the moneth next afore, they make
September.	13 ♎	36. and from them wee take away the 12.
October.	14 ♏	rest 24. So in 24. degrées, is the sunne,
Nouember.	14 ♐	of the signe of the moneth before, whiche is
December.	13 ♑	Sagittarie.

The viii. Chapter of the Eclipse of the Moone and the Sunne.

THe Eclipse of the sunne and of the moone, is a thynge that causeth great feare and admiration among the common and ignorant people, and to them that vnderstand the cause thereof, nothing at all. And therefore haue I thought good to declare the effectes thereof.

The eclipse of the moone, is the interposition or being of the earth betweene her and the sunne. And whereas the moone hath no proper light of her owne, and the earth being darke and not transparent, maketh his shadowe on the part opposite to the sunne: the moone by her proper motion doth passe by this shadowe, and is eclipsed or darkened eyther in the whole or in part, according to the portion of her that passeth by the shadowe. Moreouer (as wee haue sayde) that onely the sunne is mooued in the lyne eclipticke, and the earth being in the center of the worlde, the poynt or pricke of the shadowe shall be vnder the eclipticke. The moone declyneth from the eclipticke sometimes to the one parte, and sometimes to the other, because her eccentricke wherein she is mooued, doth cut the eclipticke equally into two halfes, so that the one halfe of the Eccentricke, doth decline from the eclipticke towarde the Northparte, and the other

The Eclipse of the Moone.

The mooving of the Sun in the Eclipse.

halfe towarde the South, and the greatest declination of it from the Ecliptike, is 5. degrees. In that maner, the Moone shalbe at no time in the Ecliptike, but only when shee shalbe in eyther of the intersections where the Eccintricke doth cut the sayde Ecliptick. That intersetion where shée passeth and goeth towarde the North part, is called the head of the Dragon and is marked thus ☊. The other where she passeth and declyneth towarde the South parte, is called the tayle of the Dragon, and is marked thus ☋. And the Sunne mooving by his proper motion, and comming to the head, then shall the shadowe of the earth bee in the tayle, because it is the poynte opposite. And if then the Moone come thyther, of her proper motion shée passeth by the shadowe, and lacking lyght of the Sunne, shée is eclipsed. And if the Sunne come to the tayle, the shadowe is the head, and then likewise shall the Moone be eclipsed, if shée passe by the head.

The head of the Dragon.

The tayle of the Dragon.

The Sunne is bigger then the earth.

The shadowe of the earth.

It is to vnderstand, that the sunne is much bigger then the earth, and by perspectiue, the shadowe of the earth, in howe muche the further it parteth from it, becommeth sharper and sharper, vntyl it come to a poynt: so that the shadowe of the whole earth, is piramidally sharpe. And as the Moone is lesse then the earth, yet (although his shadowe goeth sharpning) it sufficeth to eclipse the Moone, if she passe by the middest thereof.

The

The Eclipse of the Sunne, is the interposition of the Moone betweene vs and the Sunne, as if the Sunne bee in the fourth heauen, and the Moone in the first, she beyng a darke body, and by her proper motion ouertake the Sunne, then putting her selfe betweene him and vs, she couereth him in part, or in the whole: and this is the Eclipse of the Sunne. As the Sunne also goeth euer vnder the Ecliptykes, at that tyme that he commeth to the head or tayle of the Dragon, if then the Moone make coniunction with him, shalbe the Eclipse of the Sunne, for as much as they are both vnder the Ecliptike.

The Eclipse of the Sunne.

The Eclipse of the Sunne cannot be vniuersall in the whole earth, I say, vnto all them that may see the Sunne at the time of the Eclipse, as is the Eclipse of the Moone vniuersall. For if the Moone haue one part Eclipsed, all that may see her, shall see her Eclipsed: But the Sunne some may see all wholy Eclipsed, and other in part, or other also not at all Eclipsed: and this all at one selfe same time. The cause whereof, is the diuersitie of the aspecte, which is, to see the Moone in the Zodiacke out of her place: as if the Sunne and Moone should make coniunction in the beginning of Aries, and in the head of the Dragon, they that then should be in the Equinoctial, vnder the Sunne and the Moone, or that the Sunne and the Moone should be in their zenith, they should see the Moone hide all the Sunne.

The Eclipse of the Sun is not vniuersal.

And they that should bee in the North Climates, shoulde see, that the Moone hideth or darkeneth onely the South parte of the Sunne, and not al. Againe, they on the South part, should see the Moone hide the North part of the Sunne, and not all. And if at the tyme of the coniunction, shee haue a little passed the head of the Dragon, or lacke a little to come to the tayle, so that shee be in the North latitude: they that then shoulde be in the North Climates, shoulde see the Moone Eclipse all the Sunne: and they of the Equinoctiall shoulde see onely the North parte of the Sunne Eclipsed, and they of the South shoulde see him nothing at all Eclipsed. So that although the Eclipse of the Sunne shalbe totall or perticuler, it

Howe the sun is eclipsed in the whole, or in part.

can

Of the quantitie of the Eclipſes.

cannot be vniuerſall in the whole earth.

And note, that for the quantitie of theſe Eclipſes, the Aſtronomers deuide into twelue equal partes, aſwel the Diameter of the Sunne, as of the Moone, and theſe partes they call figures, punctes, or pryckes: and according to the punctes of the Diameter of the Moone, which is couered by the ſhadowe of the earth, or the partes of the Diameter of the Sunne, which the Moone dooth couer, ſo many fingers or punctes ſhalbe ſaid to be Eclipſed. As if. 6. the halfe, if. 3. a quarter, if. 4. a terce, or thyrde parte, yf .5. three quarters, yf 8. two terces.

Why the Moone ſeemeth ſometime bigger, and ſometime leſſe then the Sunne.

The Sunne is Eclipſed in coniunctiõ, & the Moone in oppoſition.

It is alſo to be noted that although the Sunne be bigger then the Moone, yet at ſometyme the Moone ſeemeth greater then the Sunne. And thys ſhalbe when the Sunne is in the Auge of the Eccentrike, and the Moone in the oppoſite of the Auge of the Epicicle.

And when it ſo appeareth, hee may bee all Eclipſed. Sometymes alſo the Moone ſeemeth leſſe. This is when the Sunne is in the oppoſite of the Auge of the Eccentricke, and the Moone in the Auge of the Epicicle. Then although wee ſhould ſee the center of the Moone in the center of the Sunne, ſhee can not hyde him all wholye, becauſe the Sunne ſhall appeare greater.

Of this that wee haue ſayde, it followeth that all the Eclipſes of the Sunne, muſt of neceſſitie bee in the coniunction, and the Eclipſes of the Moone in the oppoſition: whereby is inferred, that the Eclipſe of the Sunne in the

the death of Christ our Redemer, was not naturall, but miraculous: forasmuche as then was. xv. dayes of the moone, at which tyme the moone is at the full, and farre distaunt from the sunne, and coulde not eclipse him. In lyke manner is to bee noted, that to see the eclipses, they of the sunne must bee in the day, and they of the moone in the nyght. And whether the coniunction be in the night, or the opposition in the day, the Astronomers make none account.

The Eclipse of the Sunne in the death of Christ.

Howe to see the Eclipses.

The. ix. Chapter, of tyme, and of the definitions thereof.

Al mouyages in tyme.

FOrasmuch as hetherto wee haue entreated of the moouinges of the sunne and of the moone, and howe all mouynge is in tyme (for that nothyng may bee mooued in any instaunt or out of tyme) it shalbe conuenient nowe to declare what thyng Tyme is, and into what partes it is deuided.

What is tyme

Time (as sayth the Philosopher) is a measure of mooving, according to fyrst and last, or before and after. Although by accident (as Armandus hath subtilly defined) Tyme may be a measure of rest or quietnesse: as measures of habites, are measures of priuations. Or Tyme may be a measure of the mooving of the fyrst moueable, called Primum mobile, and cause of generation thereby, and of corruption by accident. Tyme hath the limittes, that hath the worlde, and as the worlde, so is it the cause of the moouinge of the heauens, and beganne when GOD created the heauens, and shall ende when the worlde shall haue an ende, as the holy schooles of Diuines teach vs. It is assigned to bee within the heauens, forasmuch as without them, is neyther tyme nor any naturall place. All the tyme synce GOD created the worlde, vntyll it shall haue an ende, is called Seculum, (that is) a worlde, or an age of Tyme. Albeit, this worde

Howe time is cause of generation & corruption.

The beginning and ending of time.

The space of tyme.

Seculum

Seculum in an other sence, may be extended farther then the durabilitie or continuance of the worlde, and this in holy Scripture is called Seculum seculi, that is, The worlde of the worlde: or Secula seculorum, which is as much to meane, as, The worlde and worldes to come, which signifieth eternitie, or euerlastyng worlde without ende. Likewise also, Seculum is taken for the space of a hundred yeeres, whereby in olde tyme certayne playes were called Seculares, because they were celebrate from a hundred, to a hundred yeeres. The Pope Paule the thyrde of that name, commaunded them to bee celebrate in Rome, in the yeere of. 1536. which was the yeere in the which the Seculum ended, and began a new Seculum.

Diuers moouinges and measures of tyme.

And as in tyme are diuers moouynges, so hath it diuers measures: whereof some are greater, other lesse. The greatest measure of tyme, is a reuolution of the heauens, which is slowly mooued, and the principall or chiefe of these, is that that the Sunne maketh, which we call a yeere. The lesse measure, is the mooving of the first mooueable, which mooueth most swiftly: and thys measure we call a day. And for as much as there is variation in the greatest measures, wee will in the Chapter following, intreate of the yeere, and of the diuersitie thereof.

The. x. Chapter, of the yeere, and of the diuers beginninges and reckonynges, or computation had thereof in olde tyme.

Three differences of yeeres.

The great yere.

THERE are three dyfferences of the yeere, as the great yere, called Annus magnus, the solar yere, and the Lunar yere. The great yere is the space of time in the which al the Planets return to the place where they had been sometime before. As if they all had beene in the beginning of Aries, and had begunne they course from thence and shoulde agayne all returne thither: then should be the great yeere.

By

By the description of other, the great yeere is when the eight sphere ioyntlie with all the Auges, make one perfect reuolution at the mooning of the nienth Sphere. And this shalbe in the space of.xlix thousande yeeres. The reuolution of the eight sphere.

The solar yeere, is a reuolution of the Sunne, carried by the proper mooving of his heauen vppon his Axis and Poles of the Zodiacke, ending where it beganne, and returning an other yeere by the selfe same course, as the Poet Virgil affyrmeth, saying: The solar yeere.

Atque in se sua per vestigia voluitur annus.

That is to say, The yeere turneth againe to himselfe by hys owne proper steppes.

The Egiptians lacking the vse of Letters, and hauing the same consideration, paynted the yeere like vnto an Adder, byting her owne tayle: and hereof was a ring called Annulus, as it were Annus (that is, a yeere) beeause a ring turneth round in it selfe, as doth the yeere. Of the quantitie of this yeere were diuers opinions and computations among them of auncient tyme. The Arabians and Persians accounted it regularly by xii. Moones, which are 354. dayes. Romulus gaue to his yeere x. monthes, because that tyme suffiseth to a woman to bryng foorth her birth, and also for that during so much tyme, it was not lawfull for a Widowe to marrie after the death of her husbande. Numa Pompilius added two monethes, to make it vp twelue monethes in. 350. dayes, which was the most auncient yeere of the Hebrues, according to the which, they account at this day. The Greekes and Egiptians, considering the course of the Sunne, made the yeere of.365. dayes. Then by the commaundement of Julius Caesar (whose order we nowe obserue) were added fiue houres, to the ende to make equall this number of dayes with the course of the Sunne: and hereof the Bisextile or Leape yeere had his beginning, from foure to foure yeeres. But to say the truth, they erred: The one, by somewhat too much, and the other by somewhat too litle. How the Egiptians painted the yeere. The quantitie of the yeere. The yeere of the Hebrues. The Greekes. Iulius Cæsar. Leape yeere

This yeere conteyneth.365. dayes.5. houres, 49. minutes. Dayes of the yeere.

Lyke

Beginning of the yeere.

Lykewyſe at the firſt, the yeere had dyuers begynnynges. Numa Pompilius beganne it from the Winter Solſticiall, becauſe that then the Sunne beginneth to ryſe toward vs, as Ouid affirmeth in theſe verſes.

Ouid.

Bruma noui primaeſt, veteriſque nouiſſima Solis,
Principium capiunt Phœbus & Annus idem.

Bruma is the ſtay of the ſunne in winter, the winter ſolſtitial, and ſhorteſt day of the yeere.

Which may be thus engliſhed.

Bzume is the firſt of the newe yeere,
And laſte day of the olde:
The Sunne and yeere begin at once,
As Ouid hath vs tolde.

Romulus beganne it at March, at the Equinoz of the ſpzing, becauſe that then all thinges reuiue and floziſh: And by the opinion of the Diuines, it ſeemeth good reaſon to begin the yeere at Marche, becauſe the wozlde was created the .25. of the Kalendes of Apzyll, which is the .18. of the moneth afozeſayde. Lykewyſe, God ſpeaking of this moneth to the people of Iſraell, ſayde vnto them: Thys ſhalbe the firſte of the monethes of the yere. The Arabians begyn from the Sommer ſolſtitiall, whoſe opinion is, that the Sunne was made in the ſigne of Leo. Other begyn the yere in September, about the Equinoctiall of Autumne, as do the Iewes, reſting in the authozitie of Geneſis, where it is wzitten thus: Let the earth bzing foozth greene hearbes, to haue fruite agreeable to theyz kynde. &c. And becauſe Autumne is a fruitefull tyme, they beganne from thence to account theyz yeere. The Greekes, Perſians, and Egiptians account it from October. The Chziſtians, ſome from the Incarnation of Chziſte, other from his birth, and other from the firſt day of Januarie.

The creation of the worlde Exod. xii.

Where the Chriſtians begin the yeere.

In like manner is great diuerſitie in begynnyng the number of yeeres, whiche we call Era, that is the date. The Greekes beganne theyz date from the death of great Alexander. The Egiptians from the death of Nabuchadnezer. The Perſians,

Diuerſitie in the number of the yeeres or the date.

sians from Gesdargit. The Arabians or Moores, from the preaching of Machomet, who was after the birth of Christ, 626. yeeres. Other also from the Romane Emperours. The Christians began the account of our Sauiour Iesu Christ, 600. yeeres after his byrth, as wryteth Cardinall Cusanus. And here it shall not be from my purpose, to shewe how iustly and ryghtfully was commaunded by Don Iohn King of Spayne, the firste of that name, that in the Courtes and Parliaments which he held in Segouia, in the yeere of. 1383. leauing the dates that they had begun from the Emperour Octauian, for tributs and other payments specified in Wrytynges and Priueledges, they should no more put the date of the Emperour, for as much as the day in the which the Sonne of God became man, & was borne by the blessed Virgin, was so excellent a thing and most woorthie to be had in memorie. So that in Spayne, since that tyme, in all common Wrytinges, the date is made from the Natiuity of our Lorde, begynnyng there the first day of the yeere, and commonly the first day of Januarie. Some Astronomers begin it the first of Marche.

Machomet.

The date of the Christiās.

We haue in this Chapter entreated of the great yeere, and of the Solar yeere, with his quantitie, beginning and date. In the Chapter following, wee will intreate of the Lunar yeere, which we call a moneth.

The .xi. Chapter, of the moneth, and of his differences.

Considering the moneth absolutely without hauing respect to the Solar yeere, it may be called a yeere according to the diuision we haue made in the Chapter of the yere. For it is a reuolution of the heauen of the moone whiche moueth slowly in comparison of the firste heauen. And if we

The Lunar yeere, or moneth.

Reuolution of the Moone.

we consider the moneth as part of the yeere, then is the name of a month more proper vnto it. For this worde Mens mensis, in Latine is deriued of Mensura, whiche signifieth measure. And so the moneth and yeere referred to tyme, all may be called moneth: forasmuch as all is the measure of of time, as we haue touched in the sayd Chapter of the yeere.

The moneth is to be considered in two maners eyther (as it is) part of the Solar yeere, or is caused by the course of the Moone. The moneth that is parte of the Solar yeere, is that whiche at this day we vse. And into xii of these monethes, is the yeere deuided: as Januarie, Februarie, Marche, Aprill, May, June, July, August, September, October, Nouember, December.

The diuision of the yeere into twelue monthes.

They are not all of equal dayes Aprill, June, September, and Nouember, haue .30. dayes: all the other haue .31. except Februarie, which hath .28. and when the Bisextile or Leape is, it hath .29. The names and numbers of these monethes were assigned at the will, and pleasure of men, and the cause why they haue remayned so long time, is the authoritie of the Emperours, that ordeyned them for the common people, who accepted them by the Romane Church which admitted the vse of them.

The Lunar moneth.

The Lunar moneth hath two consyderations. The one is the tyme whiche the Moone tarrieth from that shee commeth foorth from one poynt of the Zodiacke, vntill she returne thyther by her proper mooving, and this is called the moneth of the peragration, in whiche reuolution shee spendeth .27. daies, and almost .8. houres. The other consyderation is, hauyng respect to the tyme whiche the Moone tarrieth, from that shee is in coniunction with the Sunne, vntyll another coniunction. And thys is called the moneth of Consecution, and is more then the moneth of the Peragration, by two dayes .4. houres 44. minutes. For the Sunne and the Moone being in coniunction vnder one point of the Zodiacke, and mouyng both by theyr proper moouinges, towarde the Easte, as the mouyng of the Moone is swyfter then the mouyng of the Sunne, she leaueth him behinde.

The month of peragration

The month of consecutiō

The mouing of the Sunne and Moone in coniunction.

And

And when she hath ended her moneth of peragration, she returneth to the poynt from whence she departed, and not finding the Sunne there (because in the meane time the Sunne of his proper motion hath gone almost .27. degrees) the Moone passeth from thys poynt, and in the sayde .2. dayes .4. howres 44. minutes, ouertaketh the Sunne: and so commonly hath this moneth of consecution. 29. dayes. 12. houres, and. 44 minutes. So that whatsoeuer is sayd of the Lunar moneth, is to be vnderstood of this moneth of consecution, which all they vse that account by Moones: as doo the Hebrues, Arabians, and Persians.

The Mariners ought not to neglect this computation, because it is conuenient for them to knowe the tydes, and other effectes caused by the aspectes of the Sunne and the Moone, for their aspectes do correspond to the partes of thys moneth, as the coniunction to the beginning, the oppositiõ to the middest, and the quartile aspecte to the quarter, and so of the other. Lykewise in this moneth, is considered the illumination of the Moone, and the dayes that the light fayleth her: so that neyther by day nor by nyght wee may see her, for beeing burnt vnder the beames of the Sunne. The tyme that shee is so, is called Interlunium (that is) the chaunge or hiding, which is sometime more and sometime lesse. When the coniunction shalbe from the beginning of Capricorne vntyll the ende of Gemini, and the Moone hath North latitude, and her moouyng swifte: then shall the newe Moone soone be seene, and so shall the Interlunium be but litle. And when the coniunction shalbe from the beginning of Cancer, vntyll the ende of Sagittarius, and the Moone hath South latitude, and her moouing slowe, the longer will it be or the newe Moone shewe herselfe to vs: and certain of the causes concurring, and not all, so shall the Interlunium be in a meane betweene both. There is also an other month, which is called the month of aparition, which consisteth of .28. dayes deuided commonly by 4 weekes, each weeke containing 7. dayes, for 4. times 7. is 28. of which 4 weekes the first is counted from the first appearance of the ☾ till the 7. day, and so forth from weeke to weeke so as the fourth weeke endeth at the .28.

To know the tydes by the aspects of the Moone.

The illuminatiõ or change of the Moone.

Interlunium, is the space of tyme in the which neither the old moon doth appeare nor the newe moone is seen

day, in which acompt the odde houres during the Moones abode vnder the beames of the ☉. when she is said to be combust, are not reckoned.

The xii, Chapter, of the weeke.

The weeke of the Iewes.

THE wæke is a time of seuen daies, the beginning wherof is Sunday, and so did the Iewes count their first day, saying: Prima Sabati, secunda Sabati, (that is) the first of the Saboth, the seconde of the Sabboth, &c. to the sixth of the Sabboth, and then the Sabboth. The Romanes that called the Planets Gods, forasmuch as the Sunne was principall among them,

The Romans.

called their first day, the day of the Sun, the second, of the Moone, the third of Mars, the fourth, of Mercurie, the fifth, of Iupiter, the sixth, of Venus, the seuenth, of Saturne. The christians solemnizing the Sunday, began their accompt frō it: as on such a day our Lorde was borne: on such a day he rose: and on suche a day hee sent the holy Ghost vpon his Apostles. &c. They also accompt the dayes of the wæke for Ferias.

The christians.

Ferine, signifieth vacant daies or some time holy or festiual daies.

The xiii, Chapter, of the day, and of the night.

The natural day.

THE day is of two sortes, as, the naturall day, and the artificiall day. The naturall day, is the space of time, wherein the Sunne is caried by the first moueable about the earth, from the Meridian, to the Weast, and from the Weast vnder the earth, commyng to the East, and from thence returning agayne to the said Meridian: and in this time hath the Equinoctiall giuen one whole turne, and more, suche part of it as correspondeth to the proper mouing of the Sunne: or otherwise, the natural day is a Circle discribed with the center of the sunne, at the mouing of the first moueable. The Romanes began this naturall day, from midnight, and ended it in the mydnight

The beginning of the naturall day.

night following, and so doo wee accompt it for fasting dayes: and from euening to euening, in celebrating of festiuall dayes. The Athenienses began it at the Sunne sette, or going downe of the sunne. The Babilonians, at the rising of the sunne. The Umbrians, and Ethuscos, from the midday, or noone, and ended it the noone day following. In this maner doo the Astronomers beginne it, and finde that the day shall euer begin at one selfe same houre for the qualitie of the Meridians. And yf they had begunne it from the rising or fall of the Sunne, it should not be euer at one selfe same houre, because the Sunne riseth and falleth at some times sooner, and at other times later: and so should the beginning of the day be variable. And it is to vnderstande, that when we commonly say: at the tenth day of such a moneth: the same tenth day dooeth ende the same day at noone, and the houres that runne from that noonetyde forward, are of the eleuenth day: and so doe the Astronomers accompt them. The ende of the natural day.

The day artificiall, is a part of the day natural, and is the time that the Sunne tarieth from that it ariseth in the East, vntill it fall in the Weast. And the nyght is that part that lacketh or fayleth for the naturall day, which is the time that the sunne taryeth from that he hydeth him selfe in the Weast, vntill he returne to appeare in the East: and so the day artificiall and the night, make one naturall day. And according hereunto, it is written in Genesis, that of euening and morning was made one day. Isodorus defining this artificiall day, saith, that the day is the presence of the sunne, or the being of the sunne aboue the earth: as it is night vnto vs when he is vnder it. Or otherwise, the night is the shadowe of the earth, ertended diametrally opposite to the sunne. The quantitie and differences of these dayes artificiall, and their nyghtes, and howe they increase and diminishe, we haue largely declared in the first Chapter. The artyficial day. The night.

The

The .xiiii. Chapter of houres.

Houres naturall & artificiall.

So there is two differences of the day, as the naturall day, and artificiall: ſo is there two differences of howres, as howres naturall: which correſponde to the naturall day, and howres artificiall, which correſponde to the artificiall daye. Hora or Ora is a Greeke name, and ſignifieth ende. And ſo ſay wee Ora maris, for the ende or brymme of the ſea, or the liſt or edge of apparell, as ſaith Iſodore in his Etimologies. The houre natural or equal, is a .24. part of the day natural, and is the tyme of paſſing fyfteen degrees of the Equinoctiall. Theſe 24. houres that make one naturall day: The Aſtronomers dooth begin the day at the Meridian, counting the houres after the order of the firſte moueable, which is from the ſaid Meridian, in the angle of midnight, where they account twelue houres, and from thence towarde the Eaſt, and come to ende the 24. houres in the ſame Meridian where they began, and this they vſe for the computation of the tables of the mouings of the heauens. The Aſtronomers vſe the ſame in their Inſtruments, as in the Aſtrolabie, and Dials Horizontal, & vertical, and in all other inſtruments for houres. In Spayne alſo we vſe to account theſe 24. in two times twelue, beginning at noone, and ending twelue at midnight: and againe, beginning at midnight, and ending other twelue at noone. And to diſtinct the one from the other, they call the one afternoone houres, & the other forenoone houres: and commonly we ſay fyre houres of the morning, & fyr of the euening. In Italy they account them from the falling of the Sunne vntill the next fall the day following.

The hour natural or equal

The houre artificial or temperal.

The artificiall or temperall houre, is a twelfe part of the day arcke, or the nightarcke.

They

They are called temperall houres, because they varie in the tymes that the day varieth: For in the tyme that the dayes shal be great, so shall the houres: and when the dayes shall be short, so likewise shall the houres be, and in like maner of the nightes. So that, as the artificiall day, great or little, is deuided into twelue houres: euen so the night great or lytle, is deuided into other twelue. The auncientes deuide the day into foure partes, and the night into other foure, gyuing vnto euery quarter parte three houres. At the rising of the Sunne, which was the firste houre of the fyrst quarter, they called the first houre: and three houres passed, they called the thyrd houre, and syxe houres passed of the day, they called the syxth houre, whiche was the mydday or noone tyde. Also the nienth houre, they named at niene houres past of the day. And the Sunne sette, or going downe of the Sunne, they called the euening: as sayth the Poet Virgil in this verse.

The day and night diuided into foure partes.

Ante diem clausam componet vesper olimpo.

And according to this computation, is to be vnderstood that Saynt Matthewe wryteth: That the labourers came to the Vineyarde at the eleuenth houre, whereby is meant the fyfth houre, one houre before the Sunne was set. And when we read in S. John: The ague left him the seuenth houre, &c. By this accompt it was one houre after noone, when Christ healed the sonne of the Ruler that was diseased in Capernaum. In lyke maner by these houres, the auncientes deuided the nyght into foure quarters, gyuing three houres to euery quarter. And in these foure partes of the nyght were Souldiers appointed to watche. In the firste quarter, whiche they call Canticinium (and we the first sleepe) they watched all. In the seconde, which they called Intempestiuum, being the turne of midnyght, the young men watched. In the third, which they called Gallicinium, of the crowing of Cockes, watched the Souldiers of myddle age, in the foure and laste quarter, called Matutinum or Antilucanum (that is, the spryng of the day) the olde Souldiers watshed. And thus is vnderstood the fyrst, the seconde, and thyrde watche,

Interpretatiõ of certaine places of the Gospell.

The night deuided into iiii quarters.

Foure watchies of the night.

watche of the nyght, in like maner ought the Mariners to kéep watche and warde, to auoyde aſwell the perill of the ſea, as alſo the dangers of Rouers: and to deuied the nyght qy quarters, after the maner of Souldiers, as did alſo the Mariners in old tyme.

How Mariners ought to watch.

The xv. Chapter, of the making and vſe of an vniuerſall Dyall for the day.

VVHereas in the Chapter before, wee haue intreated of houres, and theyr dyfferences, wee entende heere to deſcribe the making of an Inſtrument generall, to knowe the houres of the daye by the beames of the ſunne, whyche is done in this maner. Take a rounde plate of Laton, and let it bee called the Equinoctiall Cyrcle, the circumference whereof, you ſhall deuide into 24. equall partes by both the ſides, and from the center to euery of theſe partes, you ſhall drawe a right lyne: one of the whiche ſhall be a Meridian. And in the one parte of that, write twelue, whiche ſhalbe the houre of the mydday or Noone. And in the other part, write other twelue, whiche ſhalbe for Midnight. In the hygheſt part, turning vpon the center, towarde the right hande, wryte, one, two, thrée foure. &c. In the lower or neather parte, you ſhall count towarde the left hande, turnyng it vppon the center: ſo that the one houre of the one parte, come vppon the lyne of the one houre of the other parte: in like maner two vppon two, thrée vppon thrée, and ſo forth of the other. And note that in the lyne of fyre at after Noone, and at the lyne of the fyre in the Morning, there remaine certaine round peeces, corners, or endes, after the maner of Aris, of the thyckneſſe of the ſelfe ſame plate. Then make a halfe Circle of the ſame mettall, as bygge as the halfe circumference of the plate, and of the thyckneſſe of a peece of foure ryalles of Plate, or ſomewhat more,

To know the houres of the day by the Sunne.

more, euen as the plate it selfe, and of the breadeth of halfe a fynger, if the instrument shall be great: or lesse, if the instrument shall be lesse. This halfe circle, shall you graduate or deuide, into 180. degrées, begynning at the one ende, one, two, three and so forth vnto 90. in the myddest, and the like shall you doo from the other ende vnto the same 90. Also, you must number them in the breadth of the same halfe circle: and this halfe circle, shall you make fast on the neather part of the instrument, so that the endes thereof may be fixed in the endes of the Meridian lyne. Then through the center of the plate or Equinoctiall Circle, shal passe a rounde steele or wyre of the same mettall, made fast or soldered in it, so that it rise and come forth equally from euery side of the plate and fourth parte of the Diameter of the same, and this shalbe called the Axis or extreme of the worlde. The instrument being thus made, you shall place it, or set it in a frame, hauing two armes, standardes or arches, so that it change betwéene the saide arches, borne vp by the rounde péeces or endes of the plate, left thereof at the endes of the line of the sixe houres aforesaide, in such sorte, that being thus stayed, it may be directly turned. And in the middest betwéene these two armes, beneath in the foote of them, or where they are placed, you shall raise a pricke, or point: so that the plate whyche signifieth the Equinoctial, being perpendiculer, the brymme or edge thereof may fall vpon the point or pricke, and consequently the plate standyng playne or flatte, the nientie degrées of the halfe circle, must shewe or touche the sayde pricke, as shal also the end or extreamitie of the Axis of the worlde, and the other end shall shewe the Zenith or verticall point.

This instrument must be so placed, that the Meridian line be North and South: which you shall finde in this maner. In an open and plaine place, where the Sunne shineth for the most parte of the day, you shall make a Circle with a payre of compasses, in the middes whereof, you shall set a steele or wyer, so vpright, that it declyne not, or bende not, eyther one way or other, and the same no longer then the fourth part of the Diameter of the circle. Then in the morning when the sunne riseth, the shadowe

The placing of the Instrument.

The finding of the Meridian line.

shadowe shalbe very long, and as it ryseth higher and higher, so the shadowe wareth shorter and shorter. Then must you obserue the tyme, when the extreamitie or ende of the shadow toucheth in the circumference of the Circle, and where it toucheth you shall make a pricke. Then goeth the shadowe shortning vnto the myddaye or noone tide, and as from thence the Sunne declyneth, so dooth the shadowe encrease, and when it shall come agayne to the circumference of the Circle, you shal make another pricke. Then shall you parte in the middest, the arke that is betweene the one pricke and the other, and from the middle pricke, draw a right line to the center of the Circle: And that shalbe the Meridian line, whereupon you shal set the instrument. Furthermore, in the foote of the frame of the instrument, you shall set a compasse or Dyal, which shall shewe the Meridian line. This done, vpon the arches of the frame, & corners of the fire houres, you shall turne the Equinoctiall, so far, that it passe so much of the halfe circle by the middle pricke, howe many degrees the Pole is rayled aboue the Horizon of that region or place where you are, and then the shadowe of the wyre or steele, shall iustly shewe in the Plate, the howre, and what a clocke it is.

The elevation of the pole.

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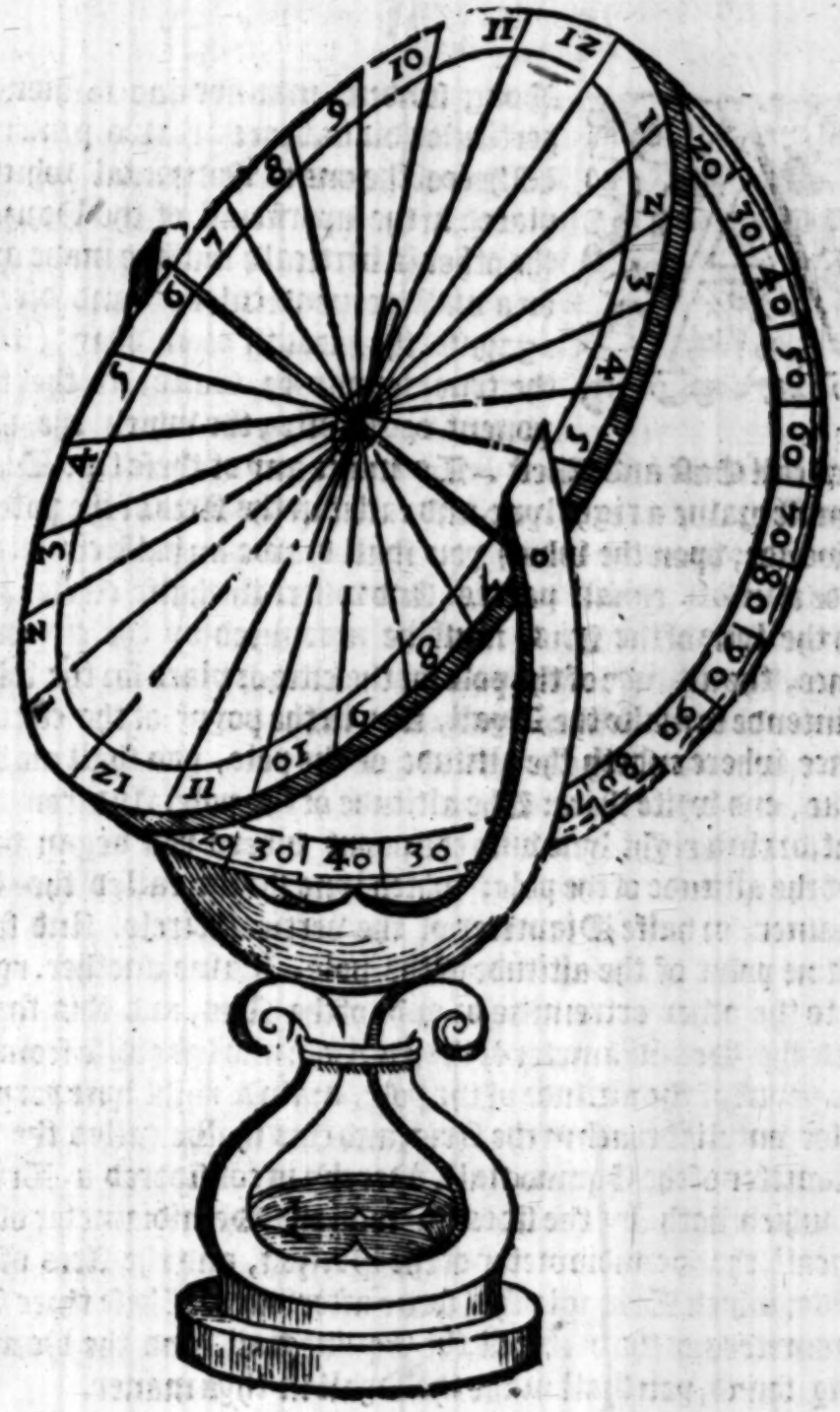
Here

Here followeth the Figure of the Instrument.



The .xvi. Chapter, of certeyne perticuler Dials, Mural, and Horizontall.

Dials Horizontall and verticall.

AMong ſundrie manner and faſhions of perticuler dials, there are two principal. Whereof the one is Horizontal which is placed in the ſuperficiall of the Horizon: the other is verticall: muſt be made or ſet on a wall perpendiculer, and directly agaynſt the South or midday, from the true leuant or Eaſte, to the true ponent or Weſte, the which the Mariners call Eaſt and Weſt. To make any of theſe two Dials, you muſt drawe a right lyne, and call it in the Axis of the poles of the worlde, vpon the which you ſhall drawe an halfe circle, and deuide it in .90. equall partes. And where the halfe circle is cut with the lyne of the Axis, muſt be accounted by the circumference, the altitude of the pole for the citie or place for the which you intende to make the Dyall. And in the poynt of the circumference where endeth the altitude of the pole, you ſhall make a marke, and write there: The altitude of the pole. And from that poynt, draw a right lyne vnto the poynt where you began to account the altitude of the pole, which lyne ſhalbe called the Semidiamer, or halfe Diameter of the verticall circle. And from the ſame point of the altitude of the pole, drawe another ryght lyne to the other extremitie or ende of the Axis, and this ſhalbe called the Semidiameter of the Horizon: and lykewiſe from the ſame poynt of the altitude of the pole, draw a right lyne perpendiculer vntyll it touch in the Axis, and this ſhalbe called the Semidiameter of the Equinoctiall. Hereby is conſidered a Triangle, which hath by the ſides thereof the Semidiameter of the verticall, the Semidiameter of the Horizon, and the Axis of the worlde: which Triangle ſhal ſerue afterward. Theſe three Semidiameters, of the verticall, the Equinoctiall, and the Horizon, beyng found, you ſhall make the Dyall in thys maner.

East & Weſt.

The triangle.

Drawe

The making of the Dyal.

Drawe a right lyne somewhat long, and call it the line of contingence. This shall you cut with an other lyne in ryght angles, after the manner of a crosse, which shalbe the Meridian lyne. Then with your compasse, take from the Triangle the Semidiameter of the Equinoctiall, and of this bignesse drawe a circle vpon the Meridian line: so that the edge or brymme of the circle, touch in the lyne of contingence: Then with a compasse, take the Diameter of the verticall circle, if you will make a Murall Dyall, or the Semidiameter of the Horizon, yf you will make a Horizontall Dyall, on a playne or flatte fourme. Therefore with such Semidiameter as you desire, you shall drawe a circle vpon the other parte of the Meridian lyne, so that the circumference thereof touch in the lyne of contyngence. Then shall you deuide the Equinoctiall circle into foure equall partes, and the quarter that is towarde the line of contingence, shall you deuide into fyre equall partes. And setting the ende of the ruler in the center of the Equinoctiall, and vpon euery poynt of them that deuide the fyre equall partes, from thence shall you drawe certeyne ryght lines, vntyll they touch in the lyne of contingence. And from these pointes of the lyne of contingence, you shall drawe other right lynes, to the center of the Horizontal circle, which lynes shalbe the determiners of the houres. And neare vnto the Meridian lyne, where it toucheth in the lyne of contingence you shall write twelue, and consequently toward the East, you shal write: one, two, three, foure, fyue, syre, and from the sixth houre, you shall drawe a ryght lyne which shall passe by the center of the Horizontal circle equally distaunt from the lyne of contyngence. The one quarter of the Horizontal beyng drawne by the selfe same, and of the same measure and bignesse shall you drawe the other, in such sort, that the same bygnesse that is from twelue to one, the selfe same shall you giue from the twelfth to the eleuenth: and the same bignesse and measure that is from one to two, shall you giue from eleuen to twelue, and so forth of the other.

And note that the Horizontal Dyall, after the syxth houre of the euening, shall haue the houres of seauen and eyght, and

Houres of the horizontal Dial.

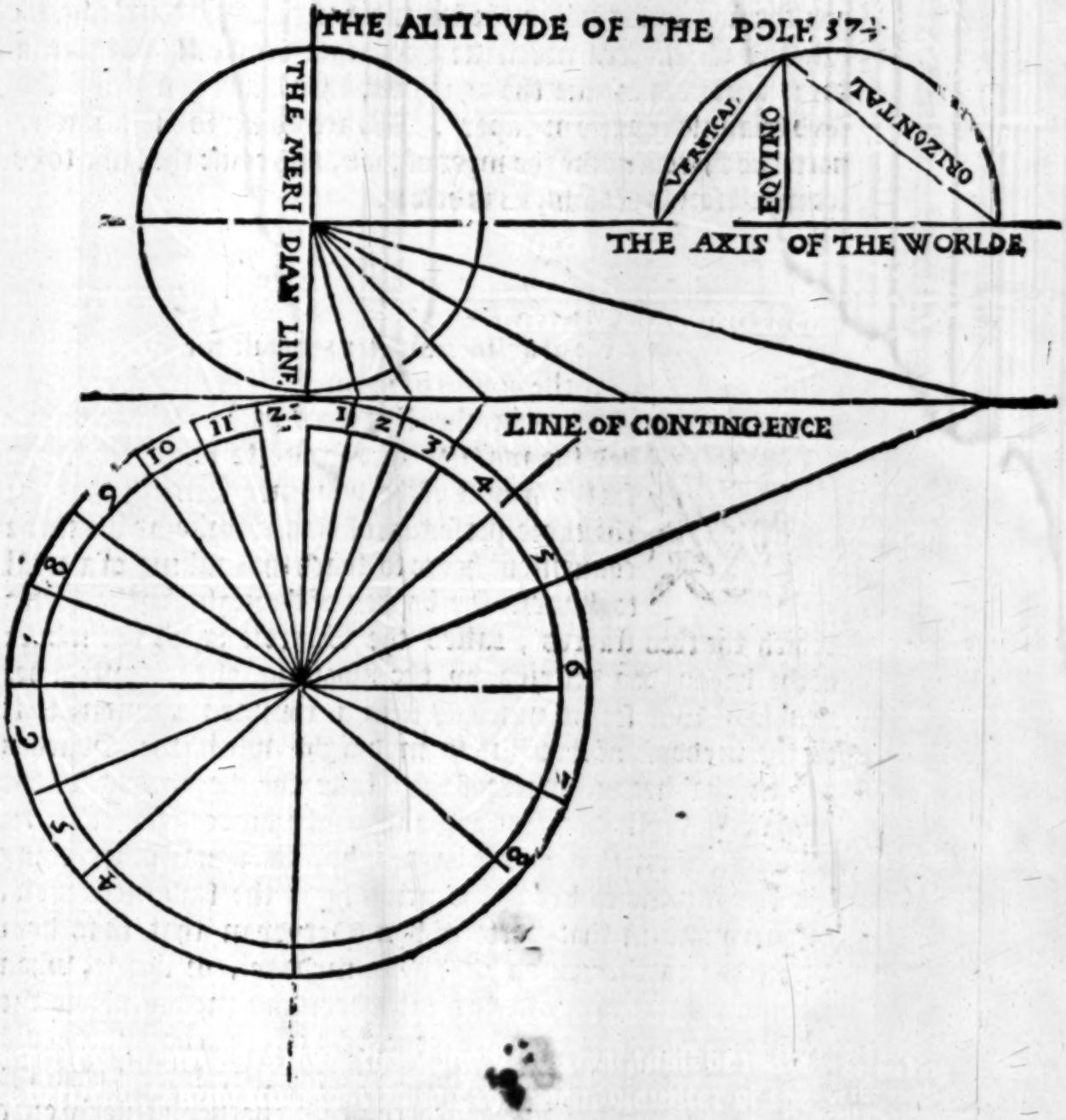
and in climates farre North.vi.also,and more yf neede shall require, and consequently must haue the houres of fiue and foure of the morning,and in climates farre North,three also: and these must be so marked, that from syxe to seuen, may be the same that is from fiue to sixe, and from seauen to eyght, the same that is from foure to fiue also, foure and fyue of the morning, as seauen and eight. The Dial being thus drawne in paper, or on a table, or any other thing, must be paynted (on a table, or in stone,or in what so euer you desire to make the Diall) a cyrcle of the same bygnesse as is the circle horizontall, and in that must be translated the lynes and numbers of the sayd circle horizontall: Then must you make a triangle of metall, of the selfe same bygnesse & fourme that is made in the middle circle: and the syde of this triangle (which is called the halfe diameter, of the horizon) must be fixed vpon the Meridian line of the horizon Diall, so that the syde of the triangle (which is the Axis of the world) and extremitie or ende thereof, may fall in the center of the horizontall Dyall, and must stand so perpendiculer, that it decline neither to the one part, nor to the other. The dyal being thus made, you shall set it vpon a Meridian lyne, so that the Meridian lyne of the Dyall may stande or rest vpon it, and so shall the shadowe of the triangle shew the houre: and if for thys place we desire to know it,we must fixe it there. And if for any other place, so setting it, we shall haue a certeyne houre. So may wee in any instaunt remoue it to another place, and likewise set it there to make certain and true demonstration of the houre.

Placing of the Diall.

The meridian line of the dial.

Here

¶ Here followeth the Figure of this demonstration.



In like maner as is made the horizontall Dyal, must be made the verticall, taking from the triangle the Semidiamiter of the Circle verticall. The making of the verticall Dyall.

And note, that for the Cycle verticall, it shall not bee

need-

nedful of more then fiue houres before none, and other fiue after noone, And the triangle must be fixt in the meridian line vpon the side that is called the Semidiameter of the Circle vertical. And if you will not make a triangle of metall, but that a wyre of yron may giue the shadowe, then must you make the sayd triangle of paste or paper. And according to the forme or patterne thereof make the wyer of yron, and cause the same to be set in all sortes of dials, as is before.

The.xvii. Chapter, of the composition and vse of an instrument generall for the houres of the night.

WHere as in the Chapters past, I haue described the manner and forme to make two dials for the houres of the day, mee seemeth that for the more perfection of this woorke, it would be conuenient heere to teach the making of a dyall to knowe the houres of the night, by the Circle which the two starres, called the Guardians, or the mouth of the horne, doo describe by the mooning of the fyxte mooueable. But for as much as it is a common opinion, that in the myddest of Aprill it is mydnight when the Guardes bee in the heade, whereof they take the beginning of the yeere, I wyll declare howe it ought to bee vnderstoode. Certeyne it is, that to bee mydnight, is none other thing but the Sunne to bee by the mooning of the fyxt mooueable, to euery one in that parte of hys Merydyan that is to hym vnder the earth, euen as is to hym mydday, or noone, when to hym it is in that parte of the Merydian that is aboue the earth. And in thys present yeere of .1545. (to be out of doubt heereof) I made experience with a precise Astrolabie, so that the fyxte or formoste Guarde starre, being perpendicularly ouer or aboue the North starre, I founde in the meridian, where the sunne maketh midnight, the .ix. degree of Taurus, whereby it followeth, that the sunne being in this degree, which is at the xix of Aprill, the same Guarde starre shalbe perpendicularly ouer

The Guarde starres.

What is midnight.

Noone or midday.

the

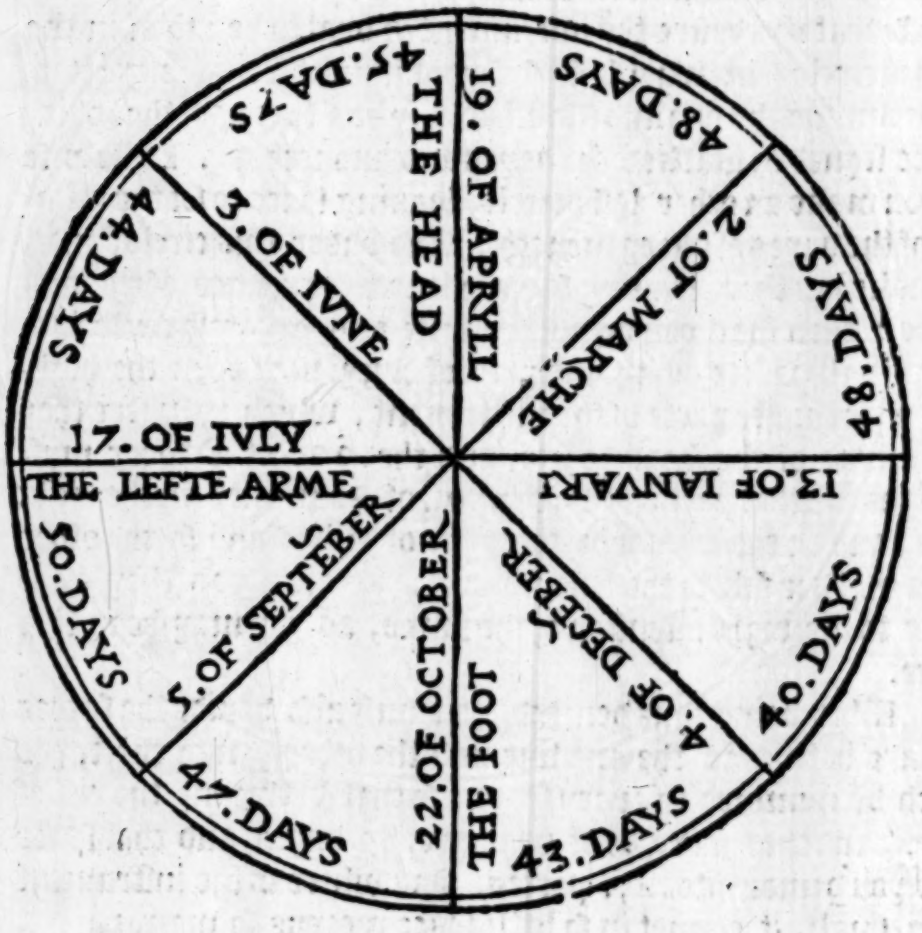
the North starre, which is the lyne of the head, and consequently the sunne being in the nienth degree of Scorpio, which is at the xrii. of October, the guarde starre shalbe in the line of the feete: and by this calculation may be knowne when it shalbe in the right or in the leafte, and in all other lynes: so that they manifestly erre, that account the mydnyght at the xb of Aprill, when the first guarde starre is in the lyne of the head, accounting a terce or thirde parte of an houre sooner and more then they should doo. An errour.

Hauing thus giuen principles for the instrument, you shall proceede in the making thereof, as followeth. In paste or on a plate of laton, make a circle of the quantitie of a spanne, or of the bignesse that you desire the instrument or dyal to be: then make an other circle somewhat lesse, so farre distaunt from the greater, that betweene the one and the other may be a space, in the which may be signed or marked the dayes and monethes. Lykewise shal you make an other lesse circle, leauing space to set the numbers of the dayes of euery moneth. And vnder this circle, shall you make another, leauing space to wryte the names of the monethes: then shall you deuide the first and greatest circle into eight equall partes, so that the xix. of Aprill may be in the highest or vppermoste parte of the instrument, which is where they say the lyne of the head to bee, and the .22. of October must be in the neather part. Also, the xiii. of Januarie, in the right arme: and in the leaft arm, the xvii. of July: and so the other dayes that doo fall to the other lynes, according as they aunswere to the right assension of the sunne, as you may see in this figure. The making of the instrument.

This being thus deuided, you must also deuide the spaces that are betweene the one line and the other, into the dayes which be numbred in euery space: so that betweene the xix. of Aprill, and the the thyrde of June, are. 45. dayes, and that space shall you deuide into. 45. partes. And whereas the instrument being small, it cannot in so little space receyue so many partes, you shall deuide it from fyue, to fiue partes, and so shall you deuide the other spaces by the numbers that are signed in them.

Then

Then one day more before the .r. towarde the lefte hand, you ſhal make a ſtrike, and there ſhall be the .rr. of Aprill. And fiue dayes more before, make another ſtrike,, and there ſhall be the .rrb. And yet other fiue dayes more before, whiche ſhall be the .rrr. of Aprill, make another ſtrike ouerthwart vnto the neathermoſt circle, and there ſhall May beginne: And from theſe dayes ſhall you beginne to account the dayes of May from fyue to fyue. And in the laſt ſpace you ſhall put fyre, which ſhall make the .rrr. dayes that May hath.



And

And there shall you make another strike, which shal trauerse or ouerthwart vnto the lesse circle. And in this maner you shall deuide the other monethes, giuing vnto euery of them the number of his daies.

This being done, vpon the outwarde part of the great circle, you shall cut downe the paper, paste, or plate of laton, leauing of the same for a signe or marke, a flower Deluce vpon the xix. of Aprill, for that it must be the head: and lykewise at the xxii. of October, may be left a handle to holde it by. Then must you make a rundel to the same paste or laton, of the bignesse of the lesse circle, without the circumference whereof, shall be left a tooth or inder, in the which you shall write, Time. And from the one syde of this inder towardes the lefte hande, you shall draw a right line that may passe through the center to the circumference, and this shall be the Meridian line. Also to this rundel you shall giue a circle, so much lower from the circumference, that there may bee left a space where the number of the dayes may be written.

And this rundle you shall deuide into 24. equall partes, beginnyng at the Meridian line of the inder at the twelfth houre of the night. Then in the nexte space towarde the left hand, you shall make the number of one. Likewise in the second space the number of two, in the thirde, the number of three, and so forth of the residue, vnto the other twelue of the day, in the oppolite or contrarie parte of the inder. So consequently procéeding i. ii. iii. &c. vnto the twelue of the inder, whiche shall be the xxiiii. houres of the naturall day.

Furthermore also you must make another péece, of the same substaunce of paste or metal, in maner of a horne, in forme and order as are in heauen the seuen starres, which make the lesse beare: And this of such quantitie, that the first or formost guarde starre, may reache without the great rundell close to the circumference thereof, hauing the North starre his center, wyth the center of the instrument. And from this starre or center vnto the firste and formest guarde starre, must be a right lyne, by the whiche the horne must be cut neare from the center, vnto the dis-

The horne of the seué starres which make the lesse beare.

couering or ſhewing of the houres. Alſo, from the firſt guarde to the ſeconde, muſt be two partes of nine, of that that is from the Starre, which ſignifieth the North to the firſte guarde. Agayne, the ſecond and laſt guard, muſt be toward the left hand ouer or aboue the firſt, three quarter partes of one halfe Circle, which hath for the Semidiameter the two partes of nyene, (whereof we haue ſpoken before) giuen vpon the right line that goeth from the North to the fyrſt guarde. Theſe two guarde Starres, muſt be boared through with holes, of the bigneſſe of an Agglet of a poynt, and likewiſe the North Starre, alſo with the two rundelles through the center, and by that, al three peeces annered, ſo that there remaine a hole in the middeſt, like the holes of the guardes, ſo that by it, and by the other of the guardes, may be ſeene the Starres in heauen, in ſuch ſorte, that the leſſe rundell and the horne may be turned round about the Axis, as dooth appeare in the demonſtration following.

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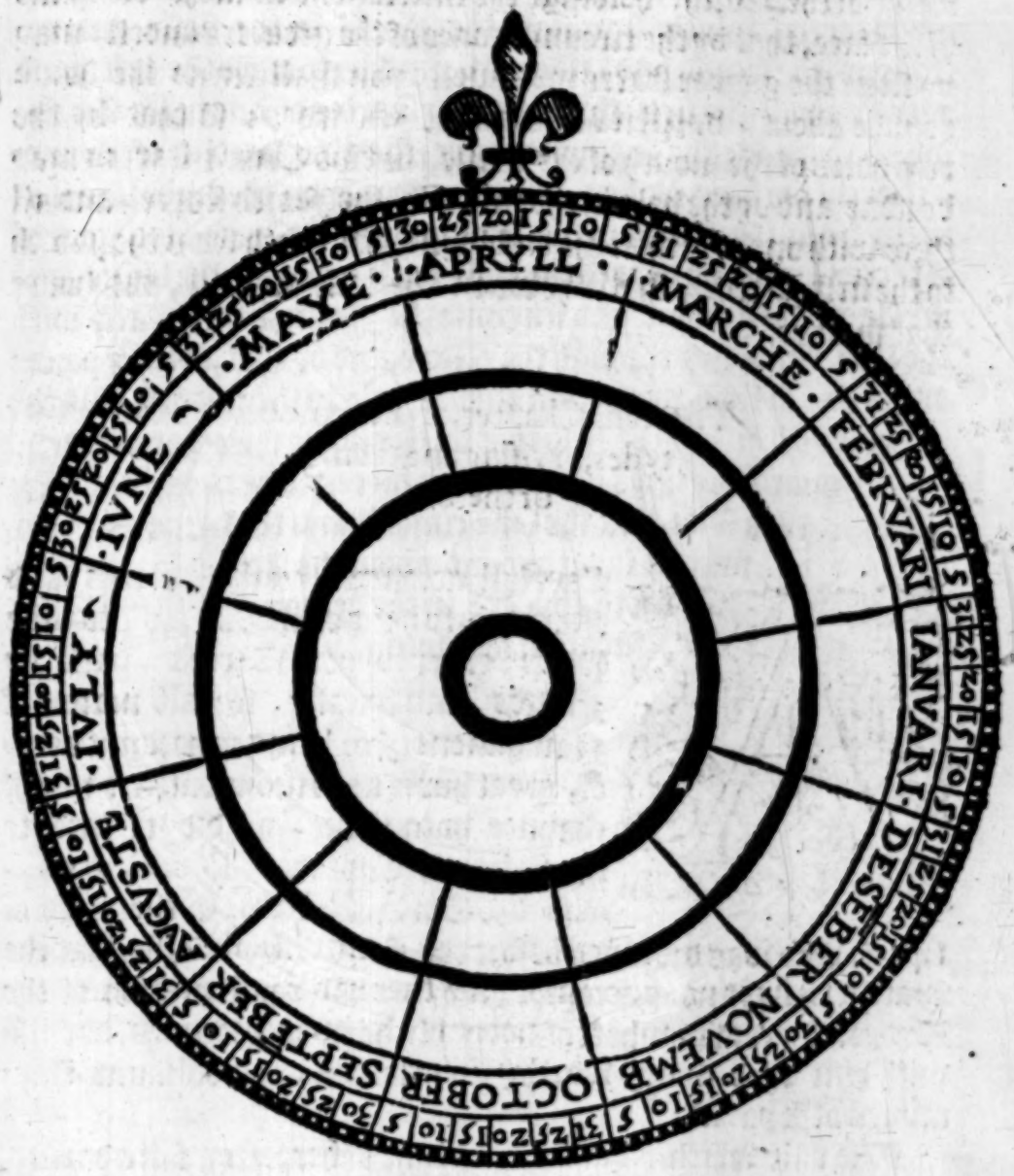


This instrument thus ended and brought to perfection, when you desire to know the houre, you shall turne the inder of the lesse rundell in the which is wrytten, Time, to that part of the great rundell where is marked the day in the whiche you desire to knowe the houre: and directing your face towarde the North, you shal make the head toward the height of heauen, at the 19. of

To finde the houre with the instrument.

Aprill. And seeing in heauen by the hole in the middest the starre of the North, holdinge the instrument in suche compasse of the face, that by the circumference of the greater rundell, may be seene the guarde starre in heauen, you shall turne the horne rounde about, vntill it fall vpon the Guardes: so that by the two holes of the mouth of the horne, the two Guard starres may be seene and by the hole in the middest, the North starre, and all three with one eye: then the right lyne that goeth from the North to the first guarde, shall shewe in the lesse rundell, the houre that shall be.

The xviii. Chapter, of the tyme of tydes, or rising and falling of the Sea.

Carefull accompte ought Pilates and Mariners to haue of the Tydes, to take Porte, enter vppon Barres, passe by Flattes, and fynally, for all maner of Nauigations. For being ignoraunt hereof, great hurte and inconuenience might chaunce vnto them, as did of late to the valiaunt Captaine, Don Iohn Gusman the Earle of Niebla, in the yeere of 1436. who was drowned before the Citie Gibraltar, for that the Mariners kept none accompt, neyther had consideration of the Tydes. By reason whereof, not onely he was drowned, but also with him dyed many worthy Gentlemen, and valiaunt Captaynes of Spayne.

The rule which Martine Curtis had hereafter sette downe, was made perticulerly for Spaine, and would not serue for any place, but onely where a North-East, or South West Moone makes a full Sea: And therefore in steede thereof I haue here set downe a generall rule for any point of the compasse whatsoeuer, by which rule as also by the instrument to that purpose following, knowing the age of the Moone, and what Moone makes a full Sea, the Tydes or founde to the very houre and minute o-

uer

uer all the worlde, as followeth: first, therefore to finde it in the Arithmeticall way, do thus.

If you desire to know at what houre is Tyde or hygh water, in any perticuler place, learne by some table, or els by some expert Mariner, what Moone makes a full Sea thereat, as also the houre appropriate to the saide point of the compasse, which done: multiply the age of the Moone by 4. deuide the produce by 5. and to the quotient, adde the houre which makes full Sea in that place vpon the change day, if it exceed 12. cast away 12. so often as you may, then the houre of the full Sea remaineth, and to euery vnitie that remaineth vpon your deuision, allowe 12. minutes, which adde to the houres, as if there remaine 1. adde 12.'. if 2. adde. 24.'. and if 3. adde. 36.'. as for example. The moone being 12. dayes olde, I desire to knowe, at what houre it is high water at London bridge: firste I consider that a South-west, or North-East moone, makes a high water thereat, and three of the clock is the houre appropriate to the point aforesaid: then according to the former rule, I multiply the age of the moone, which is 12. by 4. and it makes 48. then I deuide 48. by 5. and the quotient is 9 and 3. remaineth, which added to 3. makes 12. houres 36.'. therefore I conclude that the moone 12. daies olde, the tide is at 12. of the clocke and 36.'. at London bridge, or in any place where the like moone makes full Sea.

Againe, at Crith a West South-west, or an East North-east moone makes ful sea: the houre appropriate is 4 houres 30.'. the moone 26. daies old, I desire to know the houre of the ful sea: firste I multiply 26. the age of the moone, by 4 makes 104. which deuided by 5. the quotient is 20. and 4. remaineth, which added to $4\frac{1}{2}$. the houre when the Sunne is vpon the said point of the compasse, and it makes 25. houres 18.'. from which I take away 24 which is 2. times 12. and there resteth one houre 18.'.

And the better to vnderstande the increasing and decreasing of the Ocean Sea, it shall be conuenient to knowe the cause thereof, whereunto we say, that the moone is the cause of ebbing and flowing, or rysing and falling, increase or decrease of the Sea: not onely by her lyght, but also by her secrete or hyd propertie. The moone compasseth about the earth, from the

The Moone causeth the ebbing and flowing of the Ocean Sea.

East into the West, vntill she returne to the place or point from whence she departed: and in this course wasteth or spendeth so much more then one naturall day, in howe muche her proper mooving is more then the Sunne against the first moueable, so that she maketh her turne or course about the foure quarters of heauen in xxiiii. houres, and foure fyfthes of one houre, whiche are the twelue dgrees that she goeth more then the Sunne. And in this time the Ocean increaseth and decreaseth twyse, so that this increasing and decreasing, answereth directly to the course of the Moone: whereby it followeth, that the sea increaseth fiue houres and one fyfth parte, and decreaseth other fyue houres, and one fyfth. And if this day at the twelfth houre, was full sea, the lowe water shalbe at the fyrth houre and one fyfth parte: and at the twelfth houre and two fyfth partes it shall returne to be full sea: and at the fyrth houre and three fifthes, shall be lowe water againe: and at the twelfth and foure fifthes of the other day shalbe full Sea. So that from one day to another the tyde doth shorten foure fyfthes of an houre, which is the time that the Moone lacketh or tarieth more then one naturall day to returne to the point from whence she departed by the twelue degrees, whereof we haue spoken. Whereby it manifestly appeareth, howe they beguile themselues that say, that the sea increaseth fyue houres, and decreaseth other fyue. For if it were so, the tydes shoulde euer be at one selfe same time and houre. But for as muche as there is more then xxiiii. houres, by the sayde foure fyfth partes, thereby is caused the variation of the tydes: so that if this day, the tyde be at one of the clocke, to morrow it shalbe at one and foure fyfth partes, and the day following, at two of the clocke and three fyftes. &c.

The shortning of the tides.

An errour.

The variatiō of the tides.

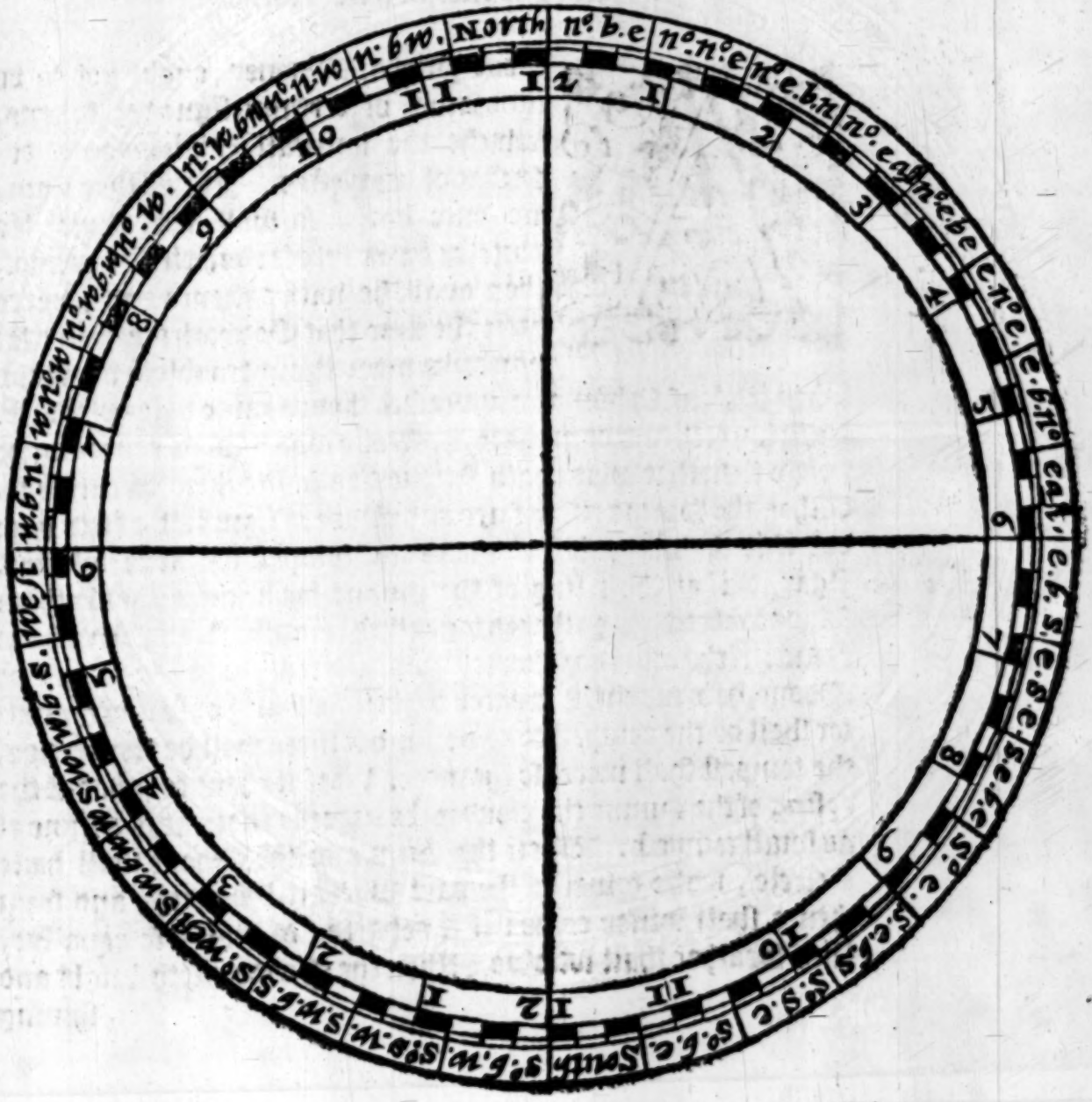
The instrument following sheweth what houre is appropriate to any point of the compasse: the vse whereof is as followeth, knowing what moone makes a full sea, lay the thrid to that point of the compasse, then turne the inder of the moone, till the day after age come iust vnder the thrid, and then the houre which the inder of the Moone cuts, is the houre of the full sea. As for Example:

Being in London where a South-west, or a North-east Moone makes high water, and the Moone 6. daies olde, I desire to know

at

at what time it is full sea the same day: first I lay the thrid vpon the South-west point, then I turne the inder of the Moone til the 6. day of her age, come right vnder the thrid, and I finde that the inder of the C, cuts ½ houre of 7. & 48.'. which is the time proposed.

Being at Graues end where a South South-west Moone makes a full sea, and the Moone 18. daies old: to finde the houre of the tide, I lay a thrid vpon the South South-west point & turning ths inder of the Moone till the 18. day of her age come vnder the thrid, & then the inder of the C cuts almost 4. of the clocke, at which time, is the tide to goe from Graues end, vpon the day proposed.



This increaſing and decreaſing of the Tydes, is not euer in equall quantitie. In the coniunctions and oppoſitions, they increaſe and decreaſe muche, whiche the mariners call high ſpring tydes, and the greateſt increaſe of all, they call the high ſpringes. In the quarters of the moone (which are at the 7. and 22. of the moone, or neare there about) they increaſe and decreaſe but little: which the mariners call nepe tydes, lowe water, dead waters, or lowe flooddes.

The xix. Chapter, of certaine ſignes, which prognoſticate tempeſtes, or faire weather.

A Good Pilot or Mariner, ought not to be ignorant of certaine ſignes or tokens, whiche the naturall Philoſophers deſcribed of tempeſtes. For as they ſignifie vnto him, ſo ſhall hee leaue his porte, or enter into it: which if he cannot, then ought he with patience and hope, to tarie the time that God hath appointed for him, who moueth and troubleth the Seas when it pleaſeth him, and appeaſeth them againe at his pleaſure. Leſſe hurteth and damageth the ſtroke which we ſée comming, or foreſée then that which hath ſtricken vs, and taken vs careleſſe. When the Sunne riſeth faire and cleare, it ſignifieth a faire day: but if it ſhewe yealowe, or deadly, tempeſt is like to followe. Agayne, if at the riſing of the Sunne his beames ſhewe themſelues contracte, or gathered togeather, and ſhort, you ſhall haue raine: if the miſtes or cloudes make a circle about the Sunne or Moone, how much the greater that circle ſhall be, ſo much greater ſhall be the tempeſt to come: and if there ſhall be two circles, the tempeſt ſhall increaſe the more. And if it chaunce, that at the ryſing of the Sunne the cloudes be turned redde, it is a ſigne of no ſmall tempeſt. When the Sunne or the Moone ſhall haue a circle, looke towarde the part where it breaketh, and from thence ſhall winde come: if it departe, or diſpearſe equallye, faire weather ſhall followe. When the Moone riſeth bright and

Signes of faire & foule weather.

ſhining

shinyng with pure colour, you may iudge it fayre weather: And yf red, winde: yf blacke, rayne. When in the newe Moone, the hornes or corners appeare grosse or great, it is a token of tempest: and if sharpe, it signifieth fayre weather. The newe Moone.

This that wee haue sayde, is the authoritie of Plinie and Aristotle, to whom the prudent Marriner shall credite, vntyl he haue found other more certeyne, eyther by his owne experience, or by the experience of other wyse men, woorthy to be beleeued. And euery man ought to trauaile as muche as in him is, for the knowledge of these thinges, accordyng as God hath giuen him vnderstanding and reason to appoynte the same: and this shalbe wisedome, bearing in memorie the experience of thinges past, to gouerne presentlie, and to prouide for thinges to come. The prouidence of God is so great that depriuing bruite beastes of reason and vnderstanding, he hath giuen them sense, and naturall instincte, whereby they may knowe that, that men do vnderstande by reason. The sense of beasts in fore seeing tempestes.

By this sense and secret instincte of Nature, the Antes or Pismires, with prouidence and diligence, lay vp in store their prouision and egges, when before they feele the rayne to come. Antes. The Swallowes also when they feele the Winter comming, passe the Seas. Swallowes. Lykewise the Fyshes, when they perceyue stormes to come, goe downe to the bottome of the water, and hyde them in the mudde of the Sea. Fyshes. And although it may seeme beside my profession, to meddle with matters perteyning to Diuines, yet will I not omit to speake that Christe our Lorde sayth, as testifieth S. Mathewe. When the Phariseers with the Saduces (to tempte him) wylled him to shewe them signes from heauen, he aunswered, saying, When it is euening, you say it shalbe fayre weather, because the heauen is redde: and in the morning you say it shalbe tempest, when yee see that the heauen drayweth towarde redde. &c. They knewe by that they iudged of heauen, to determine thinges to come: as whether it were euyll to take iourney, to enter the Sea, to reape Corne, to lay it abroade, or to gather it in. I say, that to vnderstande the reason that mooued them to haue suche consideration of Math. xvii.

tyme,

The redneſſe of the euening.

tyme (whiche wee nowe likewiſe obſerue) it is neceſſarie to knowe that the redde colour which appeareth in the euenyng, ſignifieth the dryneſſe of the ayre, whereby the matter of the groſſe vapours which ſhould be conuerted into the water, is ſo much dryed that it appeareth in manner inflamed, and is therefore red, and ſo is it not aptly diſpoſed to bee conuerted into water, and is therefore the neareſt ſigne of fayre weather. The other ſigne when the heauen in the morning draweth toward

Ruddiſh colour

redneſſe (yet not redde) ſheweth manifeſtly that rayne ſhall followe. Whereof the cauſe is, that this matter is ingroſſed, becauſe this colour cannot bee but in groſſe and thicke matter, which is not dryed, and therefore is not redde, as the cloudes that apeare in the Weſt, in the time of fayre weather: but it is a matter ſomewhat troubled, and partly redde, and is therefore a confounded matter, which touched with the heate of the Sunne, and therewith broken and diſperſed, falleth downe, and is conuerted into water. And further, as touching the fayde troubled or groſſe water, I ſay, that the drye and ruddye parte thereof, is eyther turned into wynde, by dryneſſe, or els beeing compaſſed about, and encloſed with moyſte matter, is altogeather

What is tempeſt.

conuerted into rayne, and ſo maketh tempeſt. For by tempeſt is meant not onelie rayne, but alſo tempeſtious windes, with water.

Luke. xvii.

Lykewyſe it is written by Saint Luke, When you ſee a cloude ryſe in the Weſt, you ſay rayne ſhall followe: and when the winde bloweth South, you ſay it will be hot. &c. To vnderſtande this, I ſay the cauſe of this is, that rayne is made or engendred of moyſt vapours, which both may be, & are ingroſſed.

The generation of raine or cloudes.

Or otherwiſe, a cloude is a groſſe body of moyſte vapours ſo ingroſſed, and when the cloude dooth ſo ryſe, it ſhalbe a ſigne that

The qualities of windes.

rayne ſhall ſhortlie followe: for that that was ingroſſed in the cloude, ſhall ſoone be reſolued into water. To the other reaſon, why they ſay that when the winde bloweth South, it wyl be hot: I ſay that that wind is hot and drie. Furthermore it is to be conſydered, that the wyndes are ſometimes drye, and ſometymes moyſte, yet not by theyr owne propertie, but accordyng to the regions

gions by the which they passe. We see that in some one region it rayneth with one wynde, and the selfe same winde in other places dispercth the cloudes. The Northweast winde is dryc in Spayne, yet in Libia it is very moyst and raynie. The South wynde in Europe, causeth rayne in moste places, and therefore the Poets named it the winde of waters: and this winde in Palestina or Iurie is drie. The cause of this diuersitie, is, that when the winde bloweth in Palestina, it passeth by hot and dryc regions as by the dezartes of Affricke, and passeth not by any sea at al. But when it bloweth in those partes of Europe, it must of necessitie passe by, and ouer the waters of the sea Mediterraneum, or the Leuant sea, where it gathereth moysture and causeth rayne. The Leuant or East winde, in Malaga, and Gibralter, is moyste, and in Sheres De la Frontera, is hot as Hell.

The .xx. Chapter, of the bright and shynyng exhalations that appeare in the tempestes, which the Mariners call Santelmo, or Corpus sancti.

IGnorance is the mother of errours, and therefore wyll I not omitte to shewe the naturall cause heereof, although among certayne simple and ignorant people, it is accounted for a myracle, that in certaine tempests on the Sea, the Marriners see certeyne shining and bright fyres which with great superstition they kneele downe vnto, and pray vnto, affirming that it is Santelmo that appeareth vnto them, & not contented heere with, some sweare that they haue seene drops of greene wax fal downe: Other affirme that this wax is of such heat, that if it fall from the toppe of the shippe, it dooth melte the Rosen and pitche of the hatches of the shyppe with such other foolysh imaginations, and therfore it shalbe good briefly to speake hereof, to stoppe

Some cal these the fiers of S. Elin & S. Nicolas.

stoppe the mouthes of such fonde and ignorant persons. The erhalations or vapours of the grosse fumes or smokes that rise from the earth, are constrained or gathered togeather by the coldnesse of the night, and the ayre, are thyckened in the fyrst region of the ayre, next vnto the earth. This may, and is wont to be enflamed or kyndled, and if it finde a bodye wherevnto it may cleaue, it abydeth in that vntyll it bee consumed. This fyre is cleare, and shyneth, and yet burneth not. The Greekes call it *Polyduces*, and the Latines call it Castor and *Pollux*. It is accustomed to appeare vpon the shroudes, and oftentimes is seene vpon the pykes of souldiers, in the armies of men of warre, as Plinie writeth: and this, aswell by reason of continuall smoke, as also by the heate of much people. Certaine it is, that smoke is none other thing then fyre dispearsed: as flame is an erhalation or euaporation that riseth in manner of smoke, from a grosse or fat bodye, and at the time that it ryseth, beeing gathered togeather, is constrayned into flame, inuestured with fyre. This resplendence or shynyng, is also oftentimes seene, not onely in iourneying by lande, but also in sayling by riuers: and when it appeareth on the lande, it ryseth of the smoke that is gathered togeather with the colde ayre of the night, and on the bankes of riuers: this smoke is gathered of the erhalations of the water, and consequentlie beeing kyndled, appeareth bright and shynyng. But nowe let vs come to the shyppes that sayle by the Sea, and to the Mariners that are accustomed to tempestes. To them therefore I say, that that lyghte or such other lyghtes as they see, is engendred of the fumes and smokes of theyr Shyppe, with the heate of men couched close and neare togeather in a narrowe place, and when a tempest ryseth, the sayde smoke is thyckned, prest togeather, and beaten downe by the windes, in suche sorte, that beeing tossed from one side to another, it is set on fyre by mouing, and taketh hold sometime on the shroudes, and sometimes on the toppe, and sometime also in the poupe, or in the foreshippe: so that to see thys light, or the same to appeare, is a naturall thing, and not supernatural.

Wandring fyers engendred of exhalations and vapours.

Castor and Pollux.

what is smok and flame.

Exhalations of the land & water.

Exhalations and vapours engendred in ships.

When

When Captaine Vezerra was at Cozon, in the Emperours Nauie, with his company of Souldyers, hee chaunced to be in a tempest, and sawe the sayde fyre of Santelmo, which shortly after descended so lowe, that the Captaine might easily come toit: and taking it in his cloke, he founde it to be a little droppe of water. Some haue thought it to be a certeyne shyning Flye, called Taros, which the sea men some time see in a calme in the Sommer season: and thus Santelmo appeared no more. The Captaine remained astonished at the mockerie, and the other perceyued it to be no miracle. The opinion of the Mariners that affirmed it to be Santelmo, may ryse of Saint Erasmo, Bysshop of Naples, (who as they say) not onely in his life time but also after his death, was a patrone and helper of Mariners that called vpon him in tempestes. This name of Erasmo, they of Naples call Ereemo: and processe of time taking away one e. by the figure of Sincope, remayned the name of Santermo. And the Spaniardes, who neuer can long keepe any strange vocable, call it Santelmo, turning r. into .l. Yet of this Santelmo, whereof the Maryners speake, there is neyther scripture that maketh mention, nor authoritie that confirmeth it. I heare say that the Fryer preachers hadde a religious man, of commendable life, and good conuersation, named Frier Pero Gonzales, borne in Galizia, and that in his life time our Lorde dyd certaine miracles by him, and that this is he that shyneth and giueth lyght in tempestes. No doubte, but GOD worketh myracles in his Saintes, and by his Saintes, as sayth Dauid. But if this seruant of GOD was Pera Gonzales, howe then shall he be Santelmo? Another difficultie there is, as touching thys lyghte: for there are writinges of more antiquitie then the lawe of grace and commyng of Christe in flesshe, which gyue testimonye heereof. For the Poet Virgill, in the second of his Aeneidos wryteth, that his fyre appeared vpon the head of Iulius Ascanius: And Titus Liuius in his fyrste booke, affirmeth, that it appeared vpon the head of Seruius Tullius, the sixth King of the Romaines.

A shining fly

A superstitious opinion of the Mariners.

A lie of the frier preacheers.

Psalm. lxvii. testimonie of ancient auethours.

Pom-

The building of Rome.

Pomponius Articus sayth, that Rome beganne to be builded in the thyrde yeere of the thirde Olimpiades, that is, in the tenth yeere of Ionathan kyng of the Iewes, and from the creation of the worlde. 3201. yeeres, and. 729. yeeres before Christ our Sauiour was borne. The kynges of Rome were seuen, and raigned, 244. yeeres. Eusebius sayth, they raigned. 246. Seruius Tullius, raigned. 44. yeeres, Tarquinus superbus. 25. yeeres after hym. So that discounting these yeeres, it shall appeare clearely as I say. Although the yeeres were not discounted, let them reade Diadorus Siculus, an auncient wryter, let them reade Plutarchus, Aristotle, and other olde Authours that haue written heereof, and they shall finde, that if tempestes be neare vnto the Sea, these fires and lightes appeare in them: and appeared not onelie to the Gentiles, but at this day also appeare to the Turkes and Moores in tempestes. When onely one light appeareth, it is taken for an euill signe: And heereof sayde Propertius thus.

The Romaine Kinges.

Candida fœlici soluite vela toro.

One light or fire is an euill signe.

Two lights.

And why it is an euill signe, this is the cause: that if the tempest that riseth be great, it choketh the exhalation, although yet by the part least troubled, it appeareth. When there are two lyghtes, it signifieth that it is sufficient to consume the matter of the tempest, or that the tempest beginneth to ceasse, and the grosse humour hath the maistrie. But sometime it chaunceth, that two lyghtes appearing, there may be a tempest, and one appearing shall not bee so great, and oftentimes there is a tempest without any lyght at all seene. The blinde Gentilitie called these Castor and pollux and placed them in heauen in the signe of Gemini.

Castor and Pollux.

An errour of Mariners.

Nowe remaineth to aunswere to one obiection of the Marriners, who say, that neuer man that hath seene these Fyres hath perished. To thys I say, that many may see, and haue seene these lyghtes, of whom, some haue been in peryll, and some drowned: Notwithstanding, no man can affirme

fyrme, that if the drowned myght speake, they woulde say that they haue seene them. Therefore the wise Christian Mariner ought to haue a cleare conscience, and to call for the helpe of almightie GOD, lifting vp his eyes and handes vnto heauen, and say with the Prophet, Saluum me fac Deus, quoniam intrauerunt aquæ vsque ad animam meam. Saue me, oh my God, for waters haue entred euen vnto my soule. Palm.Lxviii.

(*)

Here endeth the second part.

The thyrde part, entreateth of the composition and vse of Instrumentes, and Rules for the Arte of Nauigation.

The first Chapter, of the number, order, and names of the windes.

Why Eolus was fayned God of winds

EOlus, King of the Eolus Ilandes, or Ilandes of Vulcan, was so greatly esteemed, for hauing reason and knowledge of the windes, that they of auncient time called him the God and Lorde of them. With no lesse consideration, the prudent Marriner ought not to bee ignorant of thē, for as much as the vniuersall benefit, and cōmoditie of Nauigation consisteth therein. And to haue the better knowledge thereof, you shall vnderstande, that winde is fruite of the ayre, and vapour of the earth: the which by reason of his subtiltie, perceth the ayre, striketh it, and inforceth it. Other say, that winde, is ayre, mooued or tossed by the vehement influence of vapours of contrary qualitie. It is in Latin called Ventus, because it is vehement, and violent, whose force is so great that it ouerthroweth not onely heapes of stones, or rockes, and casteth downe trees: but also disturbeth the ayre and the earth, and mooueth the seas. There are foure principal windes, which come from the foure cardinall or principall pointes of the Horizon. We haue sayd that the Meridian circle, cutteth the Horizon

What is winde.

The foure principall or Cardinall Windes.

zon in two pointes (that is) in the North and in the South, & the Equinoctial entreth it in other two, that is, in the East and West: and from these foure pointes come these foure winds whereof al the whole Scripture maketh mention. These foure winds, they in auncient time, named in this maner. That that commeth from the East, they called Subsolanus, which we call the Leuant, or East winde. That commeth from the South, they named Auster, which we call the Meridian, or South wind. That commeth from the West, they call Faucinus, whiche wee call the Ponent or West. That from the North they named Septentrio, or Aquile, or Boreas, which we call North. To euery of these foure wyndes, they adioyned two collaterall windes, in maner as followeth. That, that is from the East towarde the parte of the North, where the Tropike of Cancer aryseth, or commeth forth, they called Vulturnus: and that that is from thence towarde the part of the South, where riseth the Tropike of Capricorne, they called Furus: also that is from the West towarde the part of the South, where the Tropike of Capricorne goeth downe, they call Aphricus: and that that declineth to the North, where the Tropike of Cancer goeth downe, they call Caurus. The Collaterals of the North and the South, answeareth to the circumferences of the Polar circles: that that is from the North towarde the Leuant, or East, they call Aquilo: and that declineth toward the West part they call, Circius: that is from the South toward the East, Euro Auster, and towarde the West, Euro Aphricus: thus many hath Aristole in his Metheora. With these xii. windes, they sayled in olde time, & made their compasse by them.

Luke.xvii.

East.

South.

West.

North.

Collaterall windes.

Twelue windes.

The Hydrographers of late daies, & such as are trauailed and exercised in sayling, agree with the auncients, in the foure principall windes, although they haue chaunged the names, calling the Leuant, or Orient East: the Ponent or Occident, West: the Septentrionall, North: and the Meridionall, South. Betweene these foure windes, they deuide euery quarter of the Horizon into two halfes, made of the two nearest, in this maner. Betweene the North and the East, taking name of them both, they named the Northeast. Betweene the East and the South, they name the Southwest: and betweene the South and the West,

Eight whole windes.

Diuision of the Horizon by the foure principall windes.

South-west: betweene West and North, North-west. These eyght windes in Nauigation, they call whole windes.

Eight halfe windes.

Betweene these eyght windes, they place other eyght, that are called halfe wyndes, whyche also are named of the two that are nearest vnto them. That that is betweene the North and North-east, they call North North-east, Betweene North East, and is East North-East: and so forth of the other. Beside these halfe windes, they haue other which they call quarter windes. These take the name of the windes, to the which they decline: as if to the quarter from the North, towarde the North-east, they call it North, and a quarter toward the North-east, that is, North and by East. And that that is towarde the North-west, they call North, and a quarter toward North-west. And so of the other, as shall be verified in the figure following: whereof is gathered, that deuiding the eight principall windes into halfe windes, they are 16. And euery halfe winde deuided into two quarters, are in all 32. windes. Some haue been so curious, or rather so vainely careful! and too precise, that they haue deuided them into 64. And in the Cardes that they haue, the confusion of lynes is greater, then the profite that may bee taken thereby.

Quarter windes.

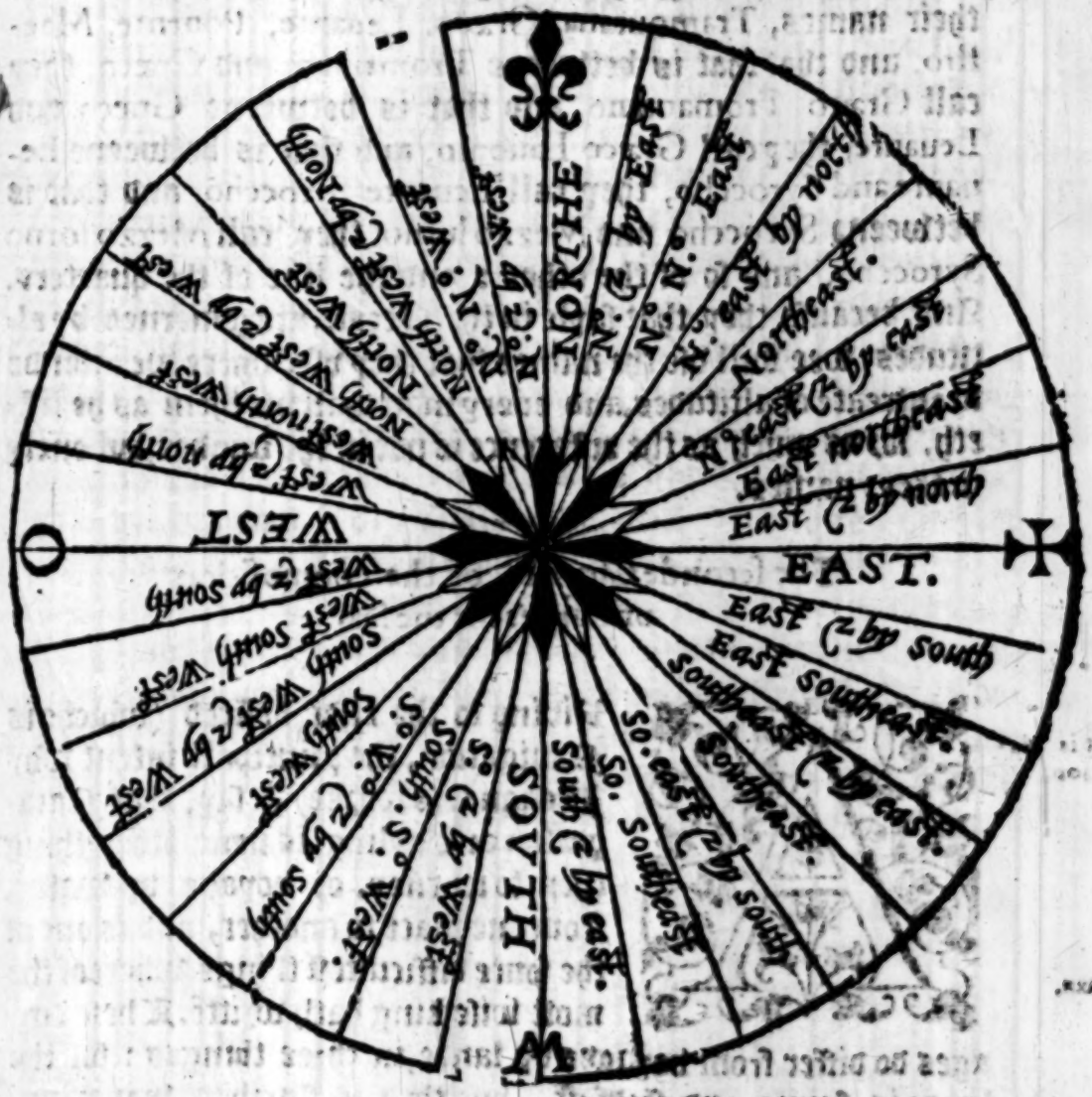
The deuision of the windes.

Xxxii. windes in all.

(.)

The

The Demonstration of windes.



These names doo they vse that sayle by the Ocean Sea: And it seemeth they had their beginning of the Almaine or Flemish tongue: for these nations chiefely sayle in the Ocean. They that sayle in the Sea Mediteraneum, or Leuant Sea, call them by other names, taking original of the Tuscan or Italian tongue. Or els that they haue denomination of the partes from whence they come, in respecte of the Sea Mediteraneum, as the wynde called Græco, because it commeth from Grecia, and

The names of the windes in the Italian or Tuscane tongue.

Libeico, because it commeth from Lybia, and Syroccho, because it commeth from Syria, and beginning at the North, these are their names, Tramoutana, Græco, Leuante, Ponente, Maestro, and that that is betweene Tromantana and Græco, they call Græco Tromantano, and that is betweene Græco and Leuante, they call Græco Lauonto, and that is betweene Leuante and Syroccho, they call Leuante Syroccho, and that is betweene Syroccho and Mezzo lorno, they call Mezzo lorno Syroccho, and so of the other: and the like of the quarters. And because they that sayle in the Ocean, are gouerned by altitudes, wee will vse the names that they vse, where we intende to entreate of altitudes, and euery man shall vse them as he listeth, for as much as the difference is not in the windes, but onely in their names.

The seconde Chapter, of the composition of Cardes for the sea.

What is Nauigation.

ARiuing to the ende desired (whiche is Nauigation, the principall intent why I began this worke) I say, that Nauigation or Sayling, is none other thing then to iourney, or voyage by water, from one place to another, and is one of the foure difficultest things, whereof the most wise king hath written. These voyages do differ from voyages by lande, in three thinges: for the lande is fyxme and stedfast, but thys is flurible, wauering, and mooueable. That of the lande, is knowen and termined by markes, signes, and limittes: but this of the sea, is vncertaine and vnknowen. And if in voyages by lande, there are hilles, mountaines, rockes, and craggie places, the sea payeth the same seuen folde with foy nents and tempestes: therefore these voyages beeing so difficult, it shalbe harde to make the same vnderstoode by wordes or writing. The best explication, or inuention, that the wittes of men haue found for the manifesting of this, is to giue the same painted in a Carde.

Pro. xxx.

The daunger & difficulty of Nauigation.

For

For the draught, or making whereof, it shall be requisite to knowe two thinges: whereof the one is, the right position of places, or placing of countries and coastes. The other is, the distances that is from one place to another, and so the Carde shall haue two discriptions. The one that answereth to the position, shall be the windes, which the Mariners call lynes or poyntes of the compasse: and the other that aunswereth to the dystances, shall be the drawing and poynting of the coastes of the land, and of the Ilandes compassed with the sea. To point the windes, or lynes, you must take skinnes of Parchment, or large Paper, of suche bygnesse as you wyll the Carde to be, and in it drawe two right lynes with blacke inke, which in the myddest shall cutte or deuide them selues in right angles, the one according to the length of the Carde, which shall be East and West, and the other North and South. Uppon the point where they cutte, make a center, and vppon it, giue a priuie or hyd circle, whiche may occupie in maner the whole Carde. This circle, some make with lead, that it may easily be put out: these two lynes deuide the circle into foure equall partes, and euery parte of these shall you deuide in the middest with a pricke or poynte. Then from one poynte to another, drawe a right Diametrall lyne with blacke incke: and so shall the circle remaine deuided with foure lynes, into eight equall partes, which corresponde to the eight windes. In like maner shall you deuide euery of the eight into two equall partes, and euery parte of these is called a halfe winde. Then drawe from euery poynte, to his opposite Diametral, a right lyne, of greene, or azure: lykewise shall your deuide euerie halfe winde in the circle, into two equall partes. And from these pointes, which deuide the quarters, you shall drawe a certaine ryght lyne with redde inke, whiche also shall passe by the center, whiche they call the mother compasse, or chiefe compasse of the Carde, being in the midest thereof: and so shall come forth from the center, to the circumference. 32. lynes, whiche signifieth the 32. windes. Beside these sayd lynes, you shal make other equall distant to them, and of the selfe same colours, in this maner. From the poyntes of the windes and halfe wyndes that passe by the center, drawe certaine right lynes, that passe

Making of Cardes for the Sea.

The winds or lines are called Rumbos in the Spanish tongue.

The mother cō, asse of the Carde 32. lins which signifie so many windes.

not by the center, but be equally distant to those that passe by the center, and of the same colours and equidistances, as are they that passe by the center. And as these lynes concurre togeather aswell in the center as in the poyntes of the windes, and halfe wyndes, that are in the circumference of the circle, they shall leaue or make there other sixteene compasses euery one with hys thyrtie and two wyndes. And if the Carde be very great, because the lines may not goe farre asunder, if you will make there other sixteene compasses, you must make them betweene the one and the other of the first sixteene poyntes where the quarters are made with theyr windes, as we haue sayde. It is the custome for the most part, to paynt vpon the center of these compasses, a flowre, or a rose, with diuers colours, and golo, differencyng the lynes, and marking them with letters and other markes: especially lining the North with a flowre Deluce, and the East with a Crosse. This beside the destinction of the windes, serueth also for the garnysshing of the Cardes. And thys for the most part is done after that the coast is drawne. And thus much suffiseth for the draught of the windes.

The placing of many compasses in the Carde.

The flower or rose of the center.

The North.

The situation of the places, Portes, and Ilandes in the Carde, according to theyr proper differences, consisteth in the particuler, and true relation of suche as haue trauayled them, and therefore for thys purpose it shalbe needfull to haue paternes of coastes, portes and Ilandes, which must bee paynted in the Carde, and these of the best & most approoued to be true: and not only to haue paternes well painted, but also it shalbe necessarie to know the true altitudes of the Pole, of certaine principal Capes, Portes, and famous Cities. This doone, they must be translated into certeyne thinne papers, and transparent that may bee seene through, and those of the best and finest that may bee had, anoynting them with oyle of Line-seede, and then dryng them at the Sunne. Then take the paterne or Card that is to be translated, and reatch or stretch it forth vpon a table. Then put the transparent paper, vpon the one side of the paterne where you will begin. And the paper beeing made fast vpon the

The situation of the place, &c.

Translatiō of the card from one to another.

paterne

patterne with plomettes of leade, or a litle waxe, that may easily be taken of, you shall in the transparent paper marke with a fine penne, one East and West, and one North and South, or two: vpon those that are seene by the selfe same paper in the patterne. And thys is called tracyng or translating. In like maner shall you trace all the costes, hauens, portes, Ilandes, cities, Capes and riuers, as appeareth in the patterne, vnto the rockes that come foorth of the water, and the knowne bankes. And because this paper dooth not suffice, you shall put thereto another, And more as neede shall require. And begyn the translation in one, where the other endeth, vntyll you haue translated all that you desyre, not forgetting to make in euery one, lynes of North and South, East and West, to serue for markes afterward. So that the lyne of North and South, of the one paper, may ioyne close and euen, with the lyne of the North and South of the other paper that is ioyned to it by longitude.

And the paterne thus translated into these papers, you must put the ruled or lyned paper or papers vpon a playne, smooth, and stedfast table, where you shall stretch them foorth, and make them fast with plomettes or weyghts, or nayle them to the table by the sides or corners, with small nayles. Then vpon the sayd ruled paper, you shall put the paper that is translated from the paterne, in that syde or part that is correspondent from ỹ paterne, to the ruled Carde. so that the lynes of East and West, North and South of the translation, may be vpon the lines that aunswere to them in the ruled Carde.

Thys paper thus made fast by the one syde or parte, you shall by the other syde (that it may remaine in his place) put vnder it an other fine paper, smoked or smyred on the neather most parte (which is that, that falleth vppon the ruled carde) eyther with a lyncke, or with matches of pitch. These thus ordered, and made fast one vppon another, you shall make a steele bodkyn or wyre, with a smooth and blunt poynt, that it race not, or bore not the paper, and with it shall you drawe, pressyng vppon all the translation, and tracing it with diligence

Some do this only with oile.

Tracing of the Carde.

and discretion, marking euer how much in it is translated from the patterne: sauing the wyndes or lynes which the Mariners call Rumbos and so shall remaine all the impression of the smoke in the ruled Cardes: vppon the which, with a fine penne you shall trace with ynke: which being dry you shall with crummes of breade make it cleane from al the smoke, and so shall the coste appeare in the Carde drawne with inke.

The painting of the Carde.

This doone, then with a small penne shall you describe in the Carde, al the places and names of the coaste in that parte where they are, and as they are seene in the patterne. And first you must describe in redde, the Portes, principal Capes, famous Cities, with other notable thinges: and all the residue in blacke. Then shal you drawe or paynte Cities, Shyppes, Banners, and beastes, and also marke the regions, and other notable thinges. Then with colours and golde shall you garnish and beautifie the Cities, Compasses, Shyppes, & other partes of the Carde. Then shall you set foorth the coastes with greene, by the shore or bankes of the lands, and make them fayre to sight with a litle saffron or otherwise, as shall seeme best. Likewise shall you describe certaine letters, with theyr significations, in thys maner.

B. for a Bay. C for a Cape. A. for an Angle. I or V. for an Ilande. M. for a Mountayne. P. for a Porte. R. for a Riuer.

The making of the trunck or scale of the leagues.

Then in place where is more roome, or that is least occupied, you shall drawe two right lynes, equally distaunt: and the one no further from the other then halfe a finger, or litle more, and so long, that betweene thē may be marked at ẏ least three hundred leagues. And this the Mariners call the truncke or scale of leagues, and place it or vse it in this maner. They take with ẏ compasse, a hundred leagues of the truncke of ẏ Carde or paterne that is translated, and they set them iust betweene the two lynes, and this space they part by the halfe ., and reste the foote of the compasse in .50. and these deuided agayne equally in two partes, they reste the compasse in .25., and the .25. being lykewise deuided, they

they rest in xii. leagues and a halfe, and marke them as heere-after shall be declared.

The graduation of the Carde.

The Carde beyng thus made, then to graduate it, or deuide it iuto degrees, you must drawe three lynes, which make ryght angles with the lyne of East and West, equidistant to the lyne of North and South: and they also shalbe North and South. These shalbee drawne by the Ilandes of Azores, or Soria, or nearer to Spayne, or where the Carde shalbee lesse occupyed. And for this purpose, the one lyne must be so farre distaunt from the other, that in the two spaces which they make, may be marked, in the one, the degrees, & in the other, the number of them, conformable to the graduation of the patterne: as the numbers of degrees shewe East and West, with the portes, capes, and costes in their proper altitudes.

And if the Carde haue no graduation, you shall take with the compasse in the truncke of the leagues, seuen spaces of 12. leagues and a halfe, which are .87. leagues and a halfe. And these must be deuided into fiue partes, which come forth at .17. leagues and a halfe for a parte: and the foure partes taken with the compasse, make foure degrees, and deuided into foure partes, euery part is a a degree, and is marked thus. o

The marke of a degree.

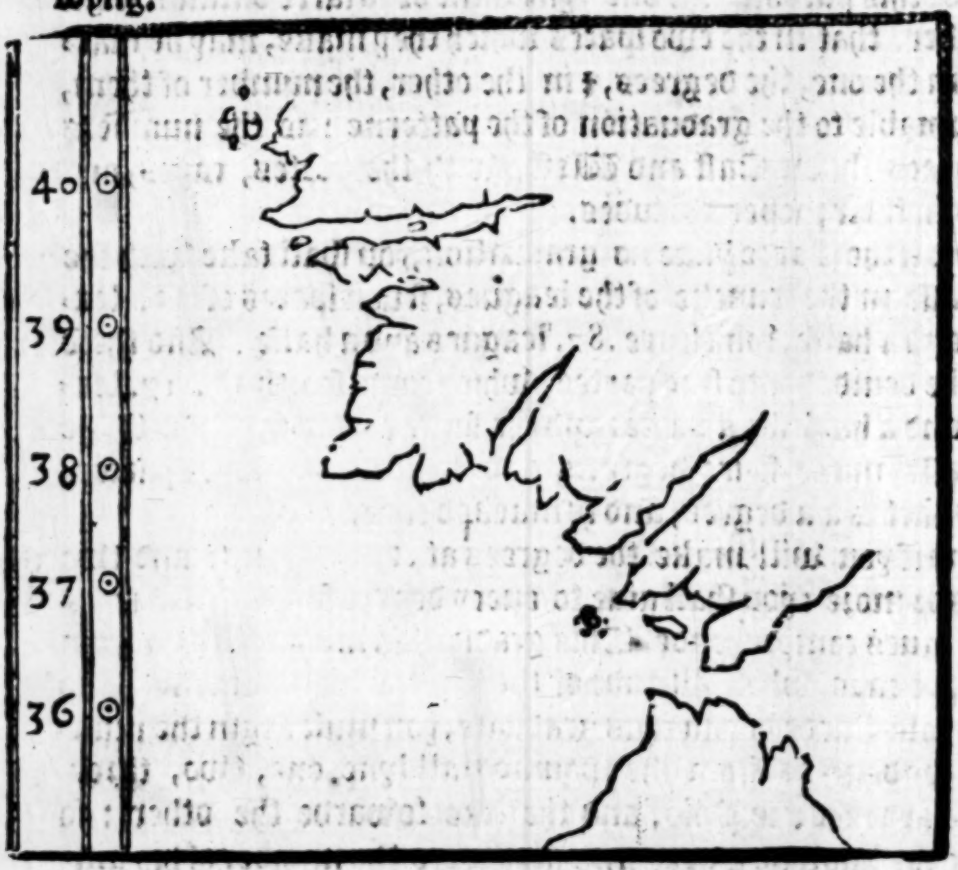
And if you will make the degrees at .16. leagues, and two terces or more: you shall giue to euery degree so much space as the leagues comprehende. This graduation must be begun from some one cape, whose altitude of the Pole is well knowne. And the whole Carde beyng thus graduate, you must begin the number of the degrees from the Equinoctiall lyne, one, two, three, &c. towarde the one Pole, and the like towarde the other: so that to the knowne Cape, may aunswere the number of his altitude. And so shall you doo to the whole Carde. Also, the Equinoctiall lyne shalbe marked in his proper place.

And

And in like maner shall you marke the Tropickes according as they are in the sphere. But forasmuch as in Spaine, Cape saint Vincent is the principall, they beginne there to make graduation and number it in 37. degrées. And from thence towarde the Pole Artike, the degrees do encrease. And from thence towarde the Equinoctiall line, they deminishe: and from that lyne, to the pole Antartike, they encrease againe (as we haue saide) as is conteyned in the Carde, and as appeareth in this demonstration folowyng.

Cape. S. Vincent.

Increasing & diminishing of the degrees.



If the paterne haue neyther league nor degree.

And if the paterne haue neither leagues nor degrées, you must take or knowe the altitudes of two Capes, that are North, and South, of the degrees, and the difference of the degrées of the eleuation, that is from the one Cape to the other, ye shall deuide all that space in so many partes, and so eche one parte shall be seuenténe leagues and a halfe, as answeareth to one degrée.

grée. Or according to the opinion of the leagues of the roundnesse of the earth, as we haue saide, as touching this in the eyghteenth Chapter of the first parte. In Spaine they vse wyth the compasse to take the space that is from Cape saint Vincent, to the middest of the greatest Ilande of Berlinga, whiche they account three degrées: so that after seuenténe leagues and a halfe for a degrée, they are 52 leagues and a halfe: and so much do they put in this space. Other put fyftie leagues, accompting after syxténe leagues and two terces for a degrée: and in thys maner they make of leagues, degrées, and of degrées, leagues. The sayling Cardes, haue no certaine bignesse limitted them, because they onelye represent the description of the water and earth and not the quantitie, and for this cause some are pointed in great space, and other in little. They that are in great space, are more manyfest and more precise: and these the Mariners call Cardes of the largest pricke or draught. Some desyre rather to haue them in lesse space, because they are brieffer, and conteyne much in little roome: and these they call Cardes of the lesse pricke. And if for any consideration aforesayde, you desire to reduce any Carde from the greatest pricke to the least, or contrariwise: you must paynt onely the coaste and Ilandes on a paper, in maner as you did in the ruled Carde, of the lines or windes, I say, let it be drawen vpon paper, for destroying or racing the paterne. And when it is traced onely wyth yinke, then vpon that draught shall you drawe certaine ryght lynes equidistaunt made all by one compasse, according to the length of the Carde, and other lines that may cut them in right angles. And likewise equidistaunt, and of the same compasse that the fyrst are. The se two orders of lynes, shall deuide all the superficiall parte of the Carde into perfecte squares or quadratures. And it is to be noted, that the nearer the lynes are ioyned togeather, and the squares the lesse. so muche the more perfectly mayst be reduced, and more easily. Then shall you take another paper, greater or lesse then the Carde, according to the point that you desire to reduce it vnto, and in the length and breadeth thereof, you shall deuide so many spaces as are betweene the lynes of the other paper, and if it bee greater

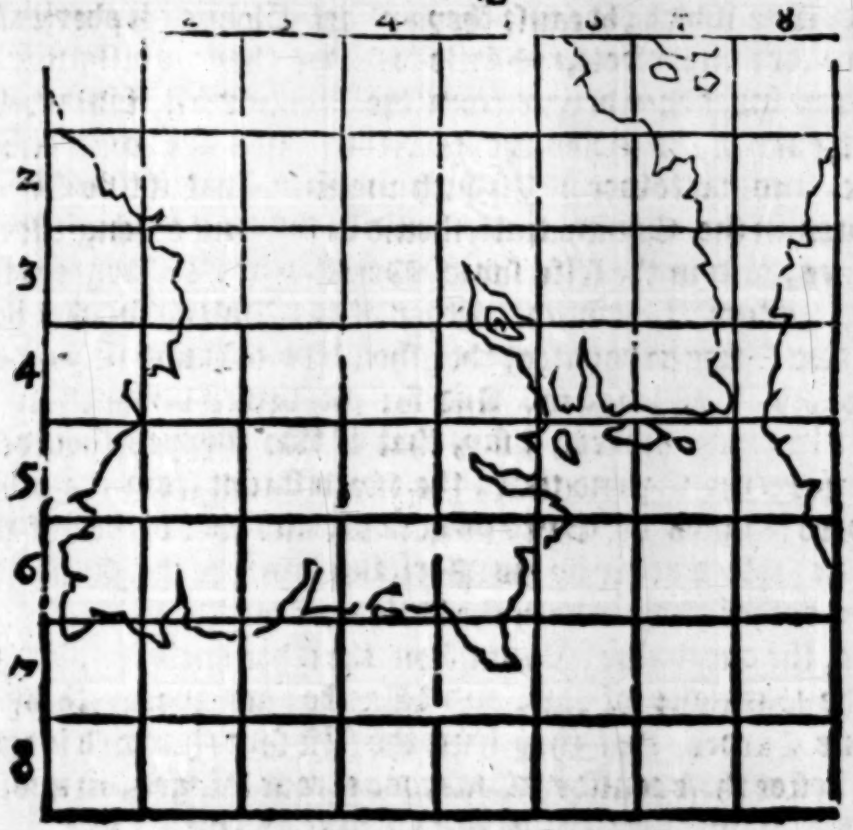
The quantity of Cardes.

The reducing of Cardes frō a bigge forme to a lesse, or the contrarie.

greater, the squares shalbe greater: and if lesse, lesse. To kéepe order in the correspondence of the squares (whiche shal be a great light to translate the one from the other) you shall number the orders of the squares, as those of the longitude, by the fronte or vppermost parte: and those of the latitude, by the syde, as wel in the one paper, as in the other, confirmable: also, those of the front, from the left hand to the right, and those of the side from aboue, downeward. Then beholde the coast howe it goeth by the squares of the first Paper, and likewise the tracting or drawing in the squares of the second, in the selfe same order and proportion, as it is there and so shall it remaine reduced to the point which you desire. And this shall serue for a paterne, to set in the ruled Carde.

Here

Herefolloweth the maner of the tranſlating of the Carde from one fourme into another, greater or leſſe.



Herefolloweth a ſimilitude of the Mariners Carde.

The

The playne Cardes are imperfect

Example of errour in the plaine cardes

The pilots and Mariners neither vse nor haue the knowledge to vse other Cardes, then onely these that are playne, as I haue sayde. The which, because they are not Globus, Spherical, or rounde: are imperfecte, and faile to shewe the true distances. For in howe much they depart from the Equinoctiall, toward whiche soeuer of the Poles, the Meridian lynes are contracte narrower and narrower: In such manner, that if two Cities or poyntes in the Equinoctiall, should be distaunt of longitude. 60. leagues, and in the selfe same Meridian at. 60. degrees from the Equinoctiall, towarde eyther of the Poles, shoulde bee other two Cities or poyntes, they should be distaunt in longitude but onely. 30. leagues. And for the better declaration and vnderstandyng heereof, I say, that if two shyppes shoulde departe from the Equinoctiall, the one distaunt from the other a hundred leagues by East and Weast, and that eyther of them shoulde sayle directly by his Meridian towarde the North: then when eyther of them hath the Pole ouer his Horizon. 60. degrees, the one shalbe distaunt from the other onely. 50. leagues. by the Paralelle of East and Weaste, as appeareth by the playne Cardes, that they haue the selfe same hundred leagues. And beside these considerations, one errour bringeth in another, & so another an other. Whereofte speake any more heere, it shalbe to certeyne Pilots (as ỳ prouerbe saith) not onely to giue musyke to the deafe, or to paynt a house for blinde men, but shall also be an endlesse confusion. Furthermore it is necessarie to consider, that good Cardes ought to haue the Coastes, Ports, Cities, and other places, situate according to the wyndes or lynes thereof, proportionally as they are in the worlde: and not by the windes that the compasse sheweth. This I say for the Northeasting or Northweasting of the compasse (called the variation) as heereafter I will touch in the fyfth Chapter. And lykewise shall you diligently obserue, that the graduation of ỳ Carde shewe the same in their proper altitudes. The cardes that lack this, ought to be corrected and amended by wise and expert men:

The ignorance of certaine Pilots.

Good cardes.

The variatiõ of the compasse.

Altitudes.

Saying

Hauing that in the Leuant sea (called Maræ Mediterraneum) and in the Chanell of Flaunders (called the narrowe seas) it is not conuenient for the nauigation, that the Portes bee marked in the Cardes by the wyndes, which the compasse sheweth, for as muche as they sayle not by the altitudes of the Pole. Lykewise, it shal not be inconusnient, but rather very necessarie (to auoyde so many errours of the which do flowe great daungers, and suche a confusion) that your Maiestie should commaund certeyne learned Cosmographers, and expert in the arte of sayling, to verifie the altitudes of ỳ Pole, that are of Ports, Capes, Ilandes, and people by the coastes of the Sea, and in like maner truely to describe the coastes of the lande, especially of the Nauigation of the West Indies, or Mundo Nueuo, where it hath pleased God that so many nations and people haue receiued the water of holy baptisme, comming to the knowledge of the true God, whereby the Christian empire is greatly amplyfied, beside the great ritches had by the sayde Indies. And this hath God miraculously wrought by the conquestes of your Maiestie, in subduing infidels, and gentiles, to the obedience of the true Catholique fayth. Whereby, not onely God hath beene well pleased, but also your Maiestie hath receyued perpetual fame, with eternal renown, and immortal glory to your posteritie in worldes to come.

In the narrow seas they saile not by elevation of the Pole.

Correction of the sea cardes.

The West Indies.

Charles the fyfth.

The thirde Chapter of the vertue and propertie of the Lode stone, called in Latine, Magues, and in Spanish, Piedramon.

The

The vertue, substance & operation of the lode stone

THe Lode-stone (as writeth Cardinall Cusanus) hath substaunce, vertue, and operation. His vertue is engendred of substaunce, essence, or beeing, and of his essence and vertue proceedeth his operation and effect, in such sort, that this stone communicating his vertue to iron, by reason therof, causeth the iron to moue, although betweene the one and the other be a cuppe or plate of siluer, or a table, or any other like thing.

Vertue attractiue.

The attractiue, or drawing force of the Lode-stone, causeth the nature of iron to bee and rest in it, and that so firmelie and quietlie, that being naturally heauie and ponderous, it descendeth not, because his nature resteth not in him selfe but is vnite with the nature of the stone, which seemeth to extende it selfe, and as it were to caste forth a liuelie spirite of inchaunting vertue. Inso much that (as we see by experience) by the sayd vnion, it not onely distributeth his vertue to one iron, but that iron likewise to another, and that other againe to another, and so forth: vntyll of many ringes or linckes of iron, be made a chaine.

Cusan applyeth this to the glorified body of Christ according to these words: If I shalbe exalted I will draw al vnto me.

Saint Augustine (as hee writeth in his bookes, De ciuitate Dei.) did meruaile that he sawe an iron moue it selfe vpon a vessell, by mouing the Lode-stone vnder the vessell.

Why the lode stone was called Magnes. & the finding thereof.

It is called Magnes, because the inuentour, or finder thereof, was so named: (who as Plinie writeth) keeping cattel in East India, had his shooes soled with plates of iron, and iron nayles, such as they vse in Gasconie, and had in his hand a staffe with a pyke, or hooke of iron: and resting him selfe vpon a quantitie of this stone, could not remoue his feete, neyther lift vp hys staffe. Then staying a while astonished, as ignoraunt of the cause, at the length began to perceiue the propertie of the stone, and to vnderstande the attractiue vertue thereof (the colour of it differeth not from iron) and was therefore called quicke iron, or liuing iron.

The

The beſt kynde of theſe ſtones, is of Auzurine or blew colour, as the ſea ſometimes appeareth. Sundry kind of the lode ſtone.

Of theſe, are founde fiue kyndes or differences. The firſt is, of Ethiope. The ſeconde, of Macedonie. The thyrde, of Lechio in Boœtia. The fourth, of Troada, neare to Alexandria: And the fyfth of Aſia: but at thys day, it is founde in diuers other places. It is founde alſo in many places in Spayne: as in the hyll Morena, neare vnto the village of Calera, beeing of the order of ſaint Iames, in the prouince of Leon. Lykewiſe in a hyll of Moron, in the territorie of the Earle of Vrenia, is great quantitie therof, and in diuers other places. The ſtone that we moſt commonly vſe, is of the Ilande of Elua, of the Lord of Pomblina, whiche I iudge to be better then that of Denmarke. This and the other, haue vertue to draw iron vnto them. And true it is that Teanxedes wryteth, that in Ethiope is founde another kynde of this ſtone, that putteth iron from it. Auerroes the commentater of Ariſtotle, denyeth that Magnes draweth iron vnto it, but ſayth, that iron by his naturall inclination, dooth moue to the ſtone, as to his naturall place, by a certeyne qualitie, which the ſtone impreſſeth in iron. And beſide this vertue and propertie that it hath to drawe iron into it, it hath alſo another: and that is, that it gineth vnto iron vertue and power, to ſhewe the two poyntes of the Horizon, where it cutteth the Meridian, that is in the two wyndes, of North, and South. Theſe vertues are founde more intent, in onely two partes of the ſtone: and theſe are euer oppoſite, or contrary the one to the other, and ſo are they contrarye in operation. For iron touched with the one part, and placed where it may remoue freely, will ſhewe the North: and an other iron touched with the other parte, will ſhowe the South. Fynding this experience, may be knowne, what parte of the ſtone aunſwereth to the North, which the Marriners call the face of the ſtone, and lykewiſe of the South. This ſtone is ſo neceſſarie, that without it, Nauigation ſhoulde bee imperfecte and vncertayne, becauſe it gineth lyke to the needle and compaſſe, whiche leadeth and guideth the Pilote, that hee maye goe certeynely

The lode ſtõe of Spayne.

The Ilande of Elua.

The lode ſtõe of Denmarke

The lode ſtõe of Ethiope.

Diuers opinions of the lode ſtone.

The qualities & properties of the lode ſtone.

The partes of the lode ſtone

What part of the ſtone anſwereth to the North & South.

in

The vse and making of the Mariners compasse.

ly in the day, and not erre or wander in the nyght. Also it sheweth and directeth to compasse the worlde, and to knowe the wyndes. And therefore, forasmuch, as the compasse is so necessarie, wee intende to shew the order and manner howe it ought to be made, for it may chaunce to fayle, or be lost in the voyage.

The .iiii. Chapter, of the making of the Marriners compasse for Nauigation.

TAke suche paste or paper, whereof Cardes are made, and make in it a Circle, of the quantitye of a spanne, or lyttle more or lesse. In the whiche you shall paynte the .32. windes, with theyr colours, in suche order as wee gaue in the fyrste and seconde Chapter of the wyndes, and of the Carde, not forgetting to marke the North with a flowre Deluce, and the East with a crosse. And more then this, may euery man garnysh and beautifie the same, as seemeth best to his fantasie. Then on the lower or neather parte of this paste, you must drawe a lyne, which shalbee directly vnder that of the North and South, which shalbe the marke for the settyng of the Irons and Steeles. Then shall you take wyre of iron or steele, of the bygnesse of a great pynne, or accordyng to the bygnesse or the roundnesse of the paste, floure, rose, or flye, as it may be called. This wyre must bee bowed double, so that euery of the partes may bee equally as long as the Diameter of the flye, and a quarter parte more. The endes or poyntes of these irons or steeles, must be pynched together, and made close, and open in the middest, the one from the other, vntyll the endes come to bee equall with the extremities of the Diameter of the flye, and so shall the steeles remaine in manner in fourme of an edgge. These wyres or irons must bee made fast in the neather parte of the flye: so that theyr extremities, endes or

The floure deluce, and the crosse.

The flye, floure, or rose of the compasse.

poyntes

poyntes, come precisely by the line of North and South.

The line of the North and South.

And to fixe or fasten them so, they must bee couered with a thinne paper glued, leauing the poyntes and endes vncouered: and these endes must be touched with the Lodestone, in this maner. The part that is vnder the floure Deluce, must be rubbed on that part of the stone that aunswereth to the North, as is sayde in the Chapter before. And this shall suffice for the perfection of the compasse. Yet some there bee, that for superaboundaunce, doo touch the other parte of the iron, with that parte of the stone that aunswereth to the South, although it may suffice to touche it only with the other parte. Thys touching of the iron with the stone, that the demonstratiue or woorking vertue may shew it selfe foorth, must bee doone with giuing certeyne strokes with a hammer, on that parte of the stone wherewith the iron must bee touched, that is to say, in the North parte, or the South: and from these will come foorth of the stone certayne beardes, like small yscles, wheron you shall rubbe the point of the iron, as you woulde whet a knyfe: and so shall certaine of those beardes of the stone, cleaue and sticke fast to the iron. And the irons thus touched, with the beardes cleauing to them, you must take a pricke or poynt of laton, of Peramidall, sharpe, or steeple fourme, which is broade below, & sharpe aboue towarde the poynt, this is made round, or eyght square, as seemeth best: and in the neather parte or breadth, it must be bored (but not through) with a borer, which must also bee of Pyramidall fourme, and center into the myddest of the sayde Pyramidall pricke or poynte of laton, vnto the myddest, or somewhat more. This Pyramidall poynt (whiche the Marriners call the Capitell) muste bee of height halfe a finger breadth, or according as the compasse shalbe, and muste bee put through the center of the flye, so that the poynte come foorth on the higher parte thereof, and must there bee made faste, and well fixte. Then shall you take a rounde bore of woode, within the which the needle may bee, not touchyng the sides of the same: and this must bee of the height of

The touching of the needle with the lode stone.

The breaking of the stone to draw out his vertue.

The boxe of the compasse.

the halfe Diameter of the compaſſe. And the grounde or bottome thereof muſt be ſet to it, as the couerynge of a bore, that it may be eaſily taken of, and put on, to haue often recourſe, to touche the irons with the ſtone (which they call feeding) when neede ſhalbe, that the vertue of the compaſſe fayle not. Alſo in the middeſt of the ground, or flooze of the bore, you muſt ſet a ſharpe poynt or pryche, made of a wyze of laton, this muſt ſtande ryght vp, and vpon the pricke or poynt thereof, you muſt ſet the bored hole of the Capitell, and that the winde enter not aboue, you ſhal couer the bore with a glaſſe. And thus beeing touched with the Nozth, and conſequently all the other windes.

Feeding the needle with the ſtone.

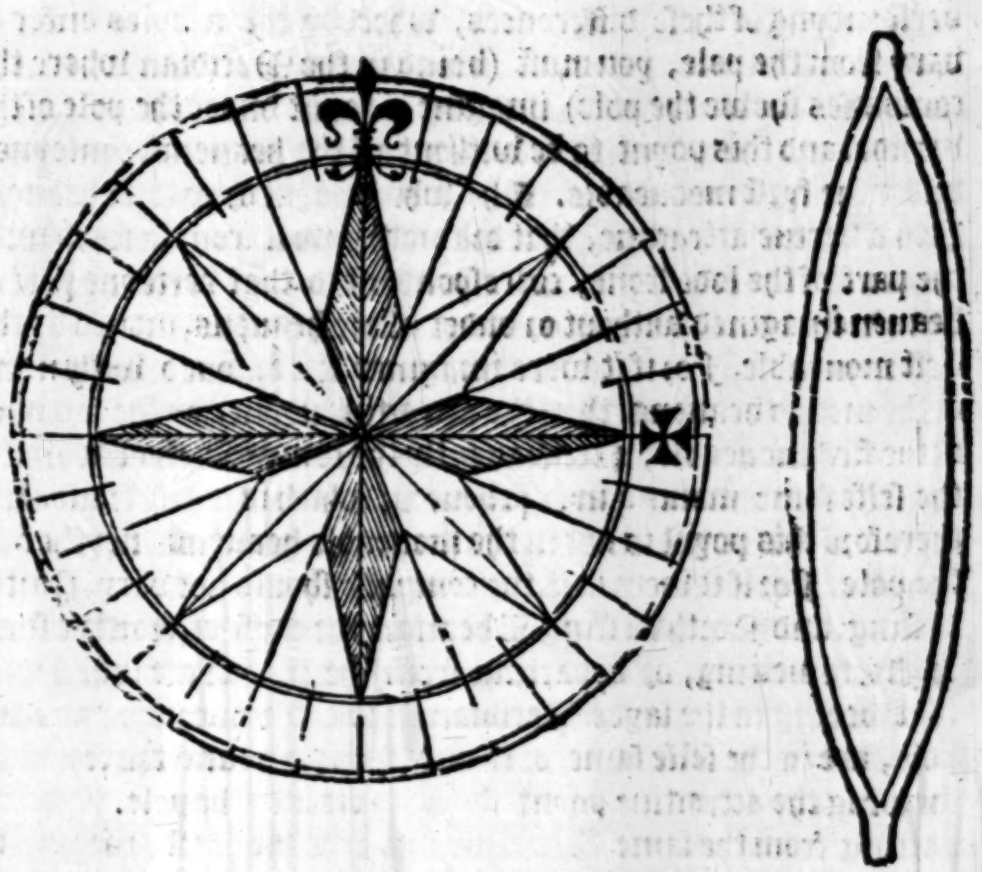
And heere is to be noted, that after the irons or neede of the compaſſe hath bëene touched in any of theſe maners, if you bring the Nozth parte of the ſtone, to the Nozth of the needle or compaſſe: then will the Nozth of the needle come to it. And if you bryng the Nozth parte of the ſtone, to the South part of the needle it will flee from it.

A notable experiẽce of the Lode ſtone.

And contrariwiſe, yf you bring the South parte of the ſtone, to the South of the needle, it will come to it, and yf to the Nozth, it will flee from it. This is vnderſtoode, the needle or compaſſe ſtanding as it ſhoulde be. And this alſo is a good ſigne, to know which is the Nozth part and South part of the ſtone.

Mozeouer, this bore muſt be put within onother bore, in the which it muſt hang vpon two circles of laton, annered the one within the other: whiche ſerue that the compaſſe ſway not, or hang not towarde the one ſyde or the other, although the Shippe ſway, and this bore alſo muſt haue his couer of wood, to kéepe the other. You ſhall lykewiſe obſerue that the poynt of the Capitell, and the hole thereof, and alſo the poynt or pricke vpon the which it reſteth, be vpright and likewiſe the Roſe, that it declyne not to one part or other. And if it bée quicker then it ought to be, then make the poynt that it goeth vppon ſomewhat blunter.

The



The v. Chapter, of the effecte or propertie, that the compasse hath to the Northeasting or Northwesting, whereby is knowen the varyation of the compasse.

MAny and dyuers are the opinions that I haue hearde, and also reade in certaine writers of latter daies, as touching the Northeasting & Northwesting of the compasse: and yet me seemeth that none dooth touch the pricke, and fewe the whyte. They call it Northeastyng, when the

The variation of the compasse.

needle sheweth or poynteth from the North (whiche is his true marke) towarde the Northeast: and Northwesting, when from the North, it declineth towarde Northwest. For the better vnderstandyng of these differences, whereby the needles differ or vary from the pole, you must (being in the Meridian where the compasses shewe the pole) imagine a poynt vnder the pole of the worlde, and this poynt to be without all the heauens, conteyned vnder the fyrst moueable. The which poynt or part of heauen, hath a vertue attractiue, that draweth vnto it iron touched with the part of the lode stone, correspondent to that certeyne part of heauen imagined without or vnder al the heauens, moued by the first moueable. For if it were imagined to be moued within any of the moued heauens, then the attractiue poynt, by the mouyng of the first moueable, & consequently the compasse, shoulde make the selfe same mouing in .24. houres, which is neuer seene. And therefore this poynt is not in the moueable heauens, neyther in the pole. For if it were in it, the compasse should not vary, Northeasting, and Northwesting. Therefore the cause of Northeasting or Northwesting, or departing from the pole of the worlde, is, that beeing in the sayde Meridian, the attractiue poynt and the pole, are in the selfe same, or in one Meridian: and the compasse shewing the attractiue poynt, sheweth directly the pole. And departing from the same Meridian towarde the East (the worlde being round) the pole of the world remaineth to vs on the least hand: and the poynt of the attractiue vertue, shalbe on the right hand, which is toward the Northeast winde. And in how much more we shall sayle toward the East, the distance shall appeare greater vnto vs, vntyll we come vnto the .90. degrees: and there shalbee the most and greatest Northeasting. And passing from thence further forward, it shall appeare vnto vs, that ỳ attractiue poynt, commeth neerer & neerer vnto the Meridian lyne: and so much shall the compasse goe bettering or amending the Northeasting, vntil it return to the selfe same Meridian in the opposite or contrary part from whence they came or where they began, & then shall the attractiue poynt be to them directly vpon, or against the pole of the worlde, & the compasse shall shewe or poynt directly toward it. And agayne, passing further forward, the pole of the worlde

This mater is since more precisely proued & corrected by M. Norman, whereof you may reade more at large in the 6. Cha. of the new Attractiue.

The cause of the variation of the cõpas.

Departing of the pole from the point attractiue.

The greatest Northeasting.

worlde shall remaine to the right hand, and the poynt attractiue to the left hand and so shall the compasse begin Northwesting, increasing it vntyll it come from thence to the .90. degrees, & there shalbee the most of his Northwesting. For turning towarde the Meridian from the attractiue poynt, it shall go amending or bettering, vntil it returne to the selfe same Meridian from whence it departed, & there shall the compasse shew the pole of the worlde directly, by, or ouer against the attractiue poynt, which is perpendicularly vnder the pole. And if from thence they shoulde turne, to passe toward the West, the pole should rest to the right hand, & the attractiue poynt to the left, & so shall the variation be to the North west: and this is the cause of the northeasting, and northwesting, or variation of the compasse. Also it is not to be vnderstoode that this northeasting, and northweasting is vniforme, as is the departing (or according to the departure) from the Meridian, where the compasse sheweth perfectly: but rather before at the beginning of the departing from the sayd Meridian, it maketh difference, or variation in a certaine quantitie & the increase that is afterward is litle, and so much the lesse, in how much the more the departing is from the sayd Meridian. For it is a passion of the circles, deuiding or cutting themselues in ỳ sphere: so that these differences are, as are they of the declinations of the Sun: which neare vnto the Equinoctials, are great, & neare to the solstitials, are litle. All the which shal euidently appeare in ỳ figure following, which is a circle diuided by two Diameters, into .4. equal partes, cutting themselues in ỳ center in right angles. And from the center point (called the pole) cõmeth foorth a moueable Meridian: & in it goeth a compasse likewise moueable about the circle. The attractiue poynt is somwhat distant from the pole of the world, and from it, commeth foorth a thred, which must euer passe by the North and South of the compasse. And the compasse beeing in the Meridian of ỳ poynt attractiue, that passeth by the pole, shall shew the pole: and without that shall go northeasting, or northwesting, so varying & departing from the true Meridian that commeth foorth of the pole of the worlde. It is the opinion of some Marines, that the Meridian where the compasse sheweth directly the pole, passeth by the Ilande of Sancta Maria, and other say, by the Ilande of Caueruo in the Asores. De-

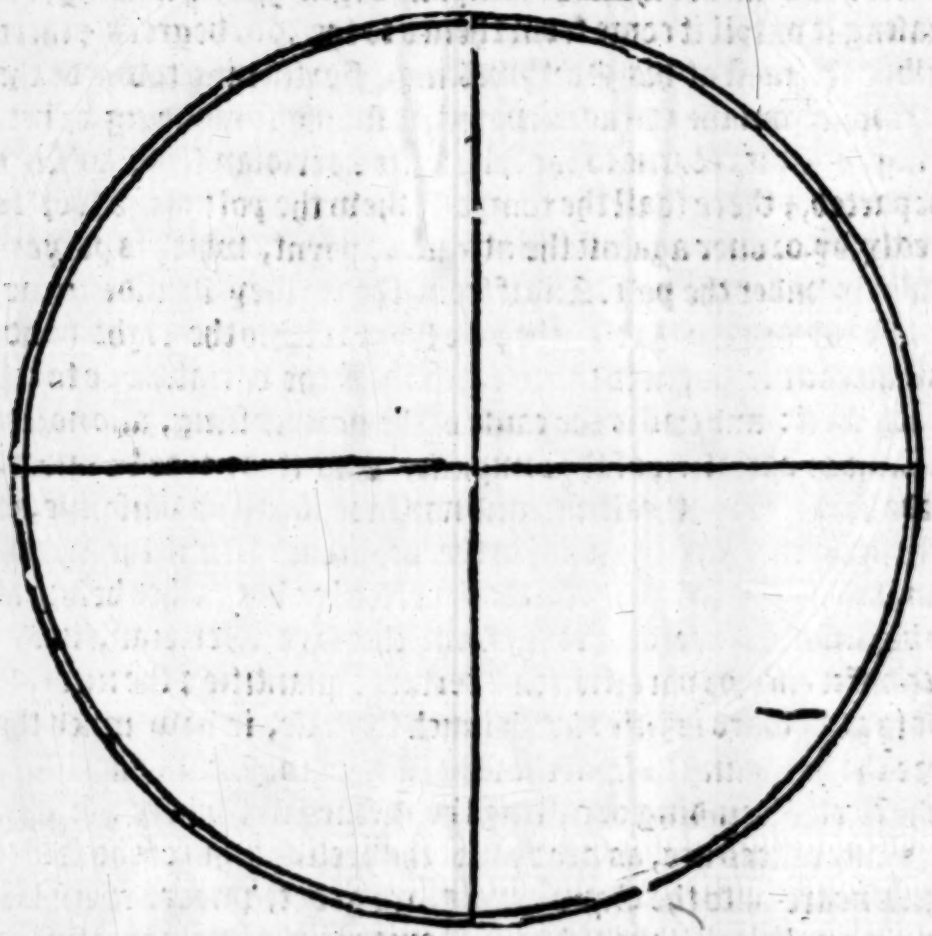
The greatest northwesting

The attractiue point is vnder the Pole.

The Northeasting & North westing is not vniforme.

The declinatiõ of the Sun

The Meridian that sheweth the Pole.



And whereas the inconuenience is manifeſt and notorious, the ſame muſt be remedied with prudence and time, and not to be negligent in the voyage: but euer to vſe & obſerue experience, more profitable then the ſubtile and curious queſtions of the ſecrete ſearchers of naturall thinges without experience, wherof reaſon taketh his principall grounde. And therefore the wyſe Pilot ought to knowe by experience (as many of them doo not) howe much a good compaſſe doth varie, Northeaſting, or Northweſting from one Port to another. So that to know howe much the compaſſe doth varie, Northeaſting, or Northweſting, from one place to another (as to ſay, halfe a quarter, or more or leſſe in quantitie as they are diſtant from the ſayde Meridian, where the compaſſes ſhewe the Pole) ſhall in the Nauigation take heede,

Experience, the grounde of reaſon.

Aduertiſemẽt to Pilottes.

and

and well consider, in any such voyage, Northealking or Northwesking, in the poyntes of the compasse. And this shalbe to sayle truely by the poyntes or lynes that the Carde dooth certainely shewe. As for example. In sayling from any Ilande that is in the sayde Meridian, or from any other parte, in seeking of any port that is to them true Northeast, yf by this way the compasse shoulde Northeast halfe a quarter, then sayling by the poyntes or lynes of the compasse Northeast halfe a quarter to the North, their Nauigation shalbe (excepting other impediments) to the Northeast which the Carde sheweth: And by this poynt or lyne, must be made the account of such a voyage. And so by the poyntes of the Carde, they shall directly finde the Port that they sought. And by this order shall they gouerne themselues in all Nauigations. For the which, it is conuenient that wise and expert Pilots, shoulde make notes of obseruations of Northealtyng and Northwealting, that is, from Port, to Port, and to make compilations and gatherings of suche notes, to carry with them in their Shyppes for regiments: and not to bee busie or curious to amende their compasses, or with the stone to rubbe the irons or Steeles, neyther on the one syde or the other, from whence the Floure deluce dooth shewe: For this shoulde cause many inconueniences. Neyther ought they to admit in theyr Cardes, two graduations: especially for that to knowe howe much in euery place the compasse doth goe aside, or vary from the true Meridian, may easily be made an instrument to shew the same by the Sunne in the day, and by the Starres in the night.

Example of sayling.

The variatiō of the compas

The .vi. Chapter, of the introduction and principles of the Arte of Nauigation.

FOr as muche as nowe wee haue the guyde, whiche is the compasse: it is conuenient to enter into the waye, whiche is Nauigation. The whiche (as wee haue sayde) is to goe or passe by water from one place to another. And thys presupposed, I say that he

In Nauigatiõ what is chiefly to be considered.

hee that desireth to attempt Nauigations, muste knowe two things which the Carde shal shewe him. The one is, by what point or line hée ought to saile: and this shall the lynes of the sayling Carde shewe him. The other is, the leagues of the distaunce: and this shall the scale or trunke of the leagues shewe, taking with a compasse the distaunce of two places, and applying it to the scale. The knowledge of these two thinges, ought the Pilot to beare in memorie: and to put them in effecte, ought to direct his forcshippe to the selfe same winde, which the compasse doth shewe. For the distaunce, he ought to knowe how much the shippe goeth dayly, wel considering and obseruing the windes, tydes, currentes, and all such thinges as may be with him, or against him. And according hereunto, he shall knowe howe muche hee hath gone, and what remaineth for him to goe, and whether he be farre off, or neare vnto the place whither he intendeth to sayle: the which in Nauigation, is the ende desired. And because this estimation or computation cannot be iust and exacte, especially in a long voyage, or in long time: it shall be conuenient that we rectifie or amend it, knowing the place where the ship is, on the superficial parte of the water, by the place that aunswereth to it in heauen. This place of heauen, is knowen by the altitude of the Pole: and by the altitude of the Pole, is knowen the altitude of the Equinoctiall: and by the altitude of the Equinoctial and declination of the Sunne, is knowen the Meridian altitude: and contrariwise, knowing the Meridian altitude and declination of the Sunne, is knowen the altitude of the Equinoctiall, and by the Equinoctiall, the pole, and by the altitude of the Pole, is knowne the altitude: and this is the place that is desired to be knowen. But for as muche as the heauen is moueable from the East to the West, this place is not knowen as a certaine poynt, but is knowen as a lyne or paralel at a certaine distaunce from the Equinoctiall, and it is knowen in what point of this paralel the Shyppe is, by the altitudes that are taken from heauen: but it is knowen by the lyne that the shippe hath gone, as we will further declare in the xiii Chapter, of making a poynt or pricke in the Carde: and in this maner you shall haue rectified the way that the shippe hath gone, and consequently the way

The distance.

The altitude of the pole & Equinoctiall.

The Meridian altitude.

To know the place of heauē

To know the way of the voyage.

that

that it hath yet to goe.

And for asmuch as these altitudes are so profitable and necessarie it shall be needefull to giue rules howe we may vse them to our most commoditie: And for this, is presupposed to knowe, that all places situate on the superficiall parte of the earth, and water, eyther they are vnder the Meridian, so that they haue, or where they haue one selfe same longitude, and differ in latitude, or are in one paralel, where they haue one selfe same latitude, and differ in longitude, or are in diuers Meridians and pareles, where they differ in longitude, and latitude. And I say, that if they haue one selfe same longitude, they sayle from the one to the other, by the lyne of North, and South, and howe many degrées doth varie the altitude of the Pole and of the Equinoctiall in heauen, so many degrées haue they gone by sea, or by lande. If two places haue one selfe same latitude, they passe from the one to the other by the line of East and West. And in suche maner of voyage the altitudes do not profite vs, because there is no variation. If they differ or varie in longitude, and latitude, they sayle from the one to the other by some of the other lines. But there are more degrées that corresponde the way that the shyp maketh, then the degrées that varie the altitudes of the Equinoctiall, and the Pole. And this difference shal be greater, in how much the line shall draw neare to the East and West: and how muche it shall drawe neare to North and South, it shall be lesse. Of the degrées or leagues that aunswere to euerie degrée of the variation of the altitude, we will entreate hereafter in the xii. Chapter.

Ruls to know the altitudes.

Longitude & latitude.

Variation of degrees.

These altitudes are knowen many waies, but especially by two: as by the Meridian altitude and declination of the Sunne (as we haue sayde) is knowen the altitude of the Equinoctiall, and by it, the altitude of the Pole. The seconde way, they are knowen by the altitude of some fixt Starre, of those that are not hydde. And among many other, the North Starre is taken, because it is nearest to the Pole. To know the altitudes by the Sunne three thinges are necessarie, that is to say, an instrument, the declination of the Sun, and rules. The instrument to knowe the Meridian altitude, shall be the astrolabie, because it is most com-

How the altitudes are knowen.

The fixt Starres.

The North starre.

To know the altitudes of the Sunne.

The Meridian altitude.

commodious for this purpose, whereof we will entreat in the Chapter following. The declination of the Sunne (which is to take it away, or to ioyne it with the Meridian altitude) we haue alredy described in the thyrde Chapter of the seconde parte. The rule to knowe when the declinations muste be ioyned with the Meridian altitude, or taken from it, we wil giue in the viii. Chapter. To knowe the altitudes of the Pole, by the altitudes of the North starre, two things are necessarie: that is, an Instrument and rules. The instr ument wherwith the Mariners are accustomed to take the altitudes of the North, they cal Belestilia, which is a crosse staffe, whereof we will write hereafter in the nienth Chapter. And the rules of the Turne or compasse, which the North starre maketh about the Pole, we will declare in the tenth Chapter.

The declination of the Sunne.

The altitudes of the Pole.

Iacobes staffe.

The vii. Chapter, of the making and vse of the Astrolabie, with the which the Mariners take the altitude of the Sunne.

TAke a plats of Copper, or latton (which for this purpose is better then any other mettall) of the bignes that you desire to make the Astrolabie, and is commonly of the biggenesse of a spanne of the Diameter, and let it be of the thickneſse of halfe a fingreat at the least: for the waightier that it shall be, so much shall it be more steady to make the altitude. This plate must bee made rounde by a circle, leauing comming foorth of the circle or corner, in the which you shall put a ring or handle with a hole, whereby you may hang the Astrolabie, by a threede or line to take the altitude.

After

After it is thus made, with the ryng or handle annered thereto: make it bright, and smoothe, pullished on both the sides, and all of one equall thicknesse, that one side be not heauier then another, which you shall trie in this maner: hang the plate by the ryng or hole that you haue made, and from the same hole hang a plomet of leade, fasted to a haire, or fine threde of silke. The Astrolabie thus hanging, free, and at libertie with the plomet, if then the threde fall vpon the center of the Astrolabie, it is wel: but if the threde doo leane or swarue to the one side, or to the other, from the center, then is that side thicker and heauier then the other, and muste therefore be made thinner, vntill the threde fall iustly vpon the center. This doone make a circle vppon the sayde center, a little within the circumference of the Astrolabie. Then drawe a Diameter from the center of the hole, in the which the ring or handle is, vnto the center of the Astrolabie, trauersing or ouerthwarting the whole circle. And this shall be called the lyne of the zenith, or verticall point: which also shall be cut with an other Diameter vpon the center, making right angles wyth it, and this Diameter shall be called the Horizontall line. These two Diameters shall deuide the circle, into foure equall partes. After this you shall make another circle, so much more within the second, that betweene the circumferences of both the circles, may be conteyned the numbers of the degrees. Then (the Astrolabie hanging before you) you shall deuide the one parte (being the superiour and lefte parte) firste into three equall partes, and euery parte shall conteyne 30. degrees. Then shall you deuide euery part of these into three other equall partes, and they shall conteyne 10. degrees: and euery of these deuide into two partes, and they shall conteyne 5. degrees. This doone, put a ruler vpon the center of the Astrolabie, applying it to euery of the pointes that deuide the sayde partes, and drawe certaine lynes that passe from the circumference of the firste circle, vnto the lesse circumference: and in the space of the lesse circle write the numbers of the degrees, beginning in the Horizontall lyne: and in that space put fiue, and in the seconde, ten, and so forth of the other, vntill the 90. degrees ende in the lyne of the zenith then shall you deuide the spaces that are betweene the firste circle and

The rectifiyng of the Astrolabie.

The threede and plomet.

The lines verticall and horizontall.

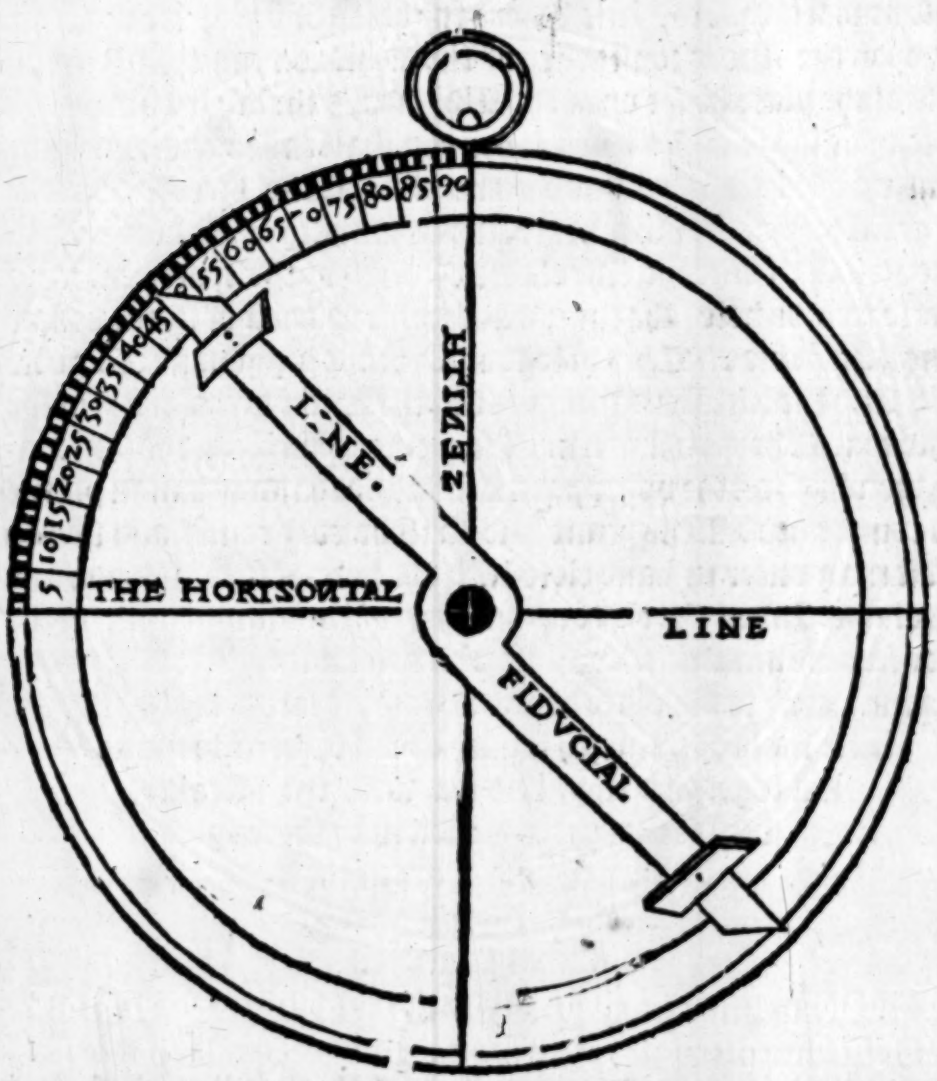
and the seconde, euery space into fyue, whiche shall make the .90 degrees. The Astrolabie thus made, you shal make the Alhidada or Label. For the whiche, you shall take a plate of laton, of the breadth of scarcely two fingers, and as thicke as the Astrolabie, also as long as the Diameter of the astrolabie: and make a line in the myddest thereof by the longitude: in the middest of this lyne, make a circle, so great that it may touche in the sides of the plate: then cut of this plate on the ons side, that which it hath from the lyne to the ryght hande, and on the other side, that that it hath from the line to the left hande, leauing the circle whole. This lyne that shall passe by the center of the circle, is called Linea fiduciæ, (that is) the lyne of confidence, whiche is that, that sheweth in the degrees, the altitude that is taken. Then shall you take away the endes or corners of the alhidada that are without the lyne, so that you touch not the lyne. This doone, you shall make two litle rising or rayed tables or plates, of the same metall whereof the astrolabie is made, and of the self same thyckneſſe that is the alhidada, or lyttle lesse, and of the breadth of the Diameter of the cyrcle of the alhidada, and let them be a thumbe in height or breadth. In the middest of these two places, by the heigth, you shall make a line. When these are made equall and all their angles right, in euery line of these that you haue made, you shall also make two holes, equally distaunt from the sides or edges of the sayde plates or tablettes. And of the two holes of euery of these lyttle plates, the one hole must be as bygge as may conteyne a great pynne: and these shall serue to take the altitude of the Starres. The other must be so subtile and small as a fine sowing needle: and these serue to take the altitude of the Sunne. They must be made in such maner, that the outwarde parte of them bee bygger, and lesse within, of the quantitie that I haue sayde. These tablets or erected plates beyng thus made, they must be sothered in the alhidada, betweene the center and extremities or endes of the same, making in it certayne notches where they may bee made faste, and sothered: or leauyng fyxte in the plates certayne sharpe poyntes or corners, that may enter into certayne holes made in the alhidada, wherby they may bee made faste vnderneath with pinnes: and they must

The Alhidada of the Astrolabie.

The holes of the Alhidada

must be so set, that the line where the holes of ỹ plates are, may fall vpon the line of confidence of the Alhidada, so that the one halfe of the plate be set vpon the Alhidada, & the other halfe without it, or at large. In like maner you shall take good aduertisement, that the great holde of the one plate, stand directly against the great hole of the other plate, and be nothing at all awry. This done, you shall bore the Astrolabie through by the center, making a verie rounde hole, that may haue in the middest of it, the center of the Astrolabie. This hole shall be of the biggenesse of a goose quill And the like shall you make in the center of the circle of the Alhidada. Then shall you make a pinne or nayle, of the same laton, the which on the vpper part of the alhidada, may haue a plaine and rounde head. This pinne also shall be very round and smoth that it may enter iust and close into the hole of the Alhidada and Astrolabie. And at the end or point thereof, comming foorth on the other side of the astrolabie, must be a hole made sideway through the pinne, close to the plate of the astrolabie, of the biggenesse of a little naile or pinne, that may be put therein, to make fast togeather the alhidada with the astrolabie, so that the alhidada may thereby be turned round about the astrolabie, as appeareth in this figure following.

To



To take the altitude of the Sunne.

To take the altitude of the Sunne, hang vp the Astrolabie by the ryng, and set the Alhidada agaynst the Sunne, and rayse it, or put it downe in the quarter that is graduate, vntill the beames of the Sunne enter in by the little hole of the other tablet or raysed plate, and precisely by the other litle hole of the other tablet. Then looke vpon the lyne of confidence: and how many degrées it sheweth in the quarter that is graduate (beginning from the Horizontall lyne) so many degrées of height hath the Sunne. In like maner shall you doo to take the altitude of any other Star, looking through the great holes, because this may hardly be seene by the litle holes.

The

The.viii. Chapter of the definition of the altitude And howe the altitude of the Pole may well be knowne by the Meridian altitude and elenation of the Sunne.

IT is conuenient to defyne the altitude, before wee giue rules of the vse thereof. The altitude of the Sunne, or the Moone, or of any other Starres, is the distaunce that is betweene it and the Horizon. And this ought to be accounted by the degrees of the great Circle, whiche passeth by the Zenith, and by the center of the Sunne, or of the Moone, or of the Starre, vnto the Horizon. And the degrees that are from the Horizon to the Starrs, or to the Sun, that is the altitude: and the degrees that are from the Center of the Starre, or of the Sunne, vnto the Zenith, is called the complement, or supplement of the altitude. The altitude of the Equinoctiall, is euer counted by the Meridian. And the degrees of the Meridian, that are betwéen the Equinoctiall and the Horizon, is the altitude of the Equinoctiall: and other so many are they, that are from the Zenith to the Pole. For the altitude of the Equinoctiall, is equall to the complement of the altitude of the Pole. The degrees of the Meridian that are betweene the Equinoctiall, and the zenith, is called the complement of the altitude of the Equinoctiall, and is equal to the altitude of the Pole. And although we haue defined the altitude in generall, yet shall wee onely profite our selues by the Meridionall altitude of the Sunne. The Meridian altitude, is the greatest altitude that the Sunne hath euery day: and this shalbe, when the Center of the Sunne is in the Meridian. And the Arke of the Meridian, that is betweene the Horizon and the Sunne, is the Meridian altitude. So that when we say the altitude of the Sunne is taken, it is vnderstoode at middaye. The shadowes that the sunne then maketh, are in three sortes.

What is the altitude of the planettes or starres.

The complement of the altitude.

From the zenith to the pole.

The meridiã altitude of the sunne

The shadows that the sun maketh at midday.

For eyther to vs it casteth the shadowe towarde the North part, or toward the South, or pendiculer by a right vp lyne, so that at mydday, or noone, nothyng that standeth vpright, giueth any shadow at all. But forasmuch as there is such variation in declinations, altitudes, shadowes, and paralelles, it shalbe necessarie to giue rules for all variations. And these shalbee reduced into foure brefe and compendious rules, the which I haue heere described, that the wyttie may haue profite by them, and the rude learne them: not caring for the rules of the Mariners, because they are so long and tedious. For (as the Philosopher sayth) it is vainely doone by many, that may well be doone by few.

Rules for all variations.

The perpẽdiculer shadow

When the shadowe shalbe perpendiculer, it is because the Sunne is in the zenith, and .90. degrees aboue the Horizon. And then how many degrees of declination the Sunne hath, so much shall we be distant from the Equinoctiall, toward the part where the Sunne declineth. And if it haue no declination, it and wee shalbe vnder the Equinoctiall.

The declining shadowes.

But when the Sunne and the shadowes shalbe to vs from the Equinoctiall, towarde one of the Poles, we shall take away the declination from the Meridian altitude, and then shall remaine the complement of the eleuation, which complement beeyng taken from .90. degrees, then shall remaine that which wee be distaunt from the Equinoctiall, towarde the same Pole.

When the Sunne declineth from the Equinoctiall, towarde the one Pole, and the shadowes shalbe towarde the other, wee shall ioyne the declination with the Meridian altitude: and if all come not to .90. then subtract them from .90. degrees, and wee shall haue the complement, and so much shall we be distant from the Equinoctiall, towarde that Pole to the which the shadowe falleth. And if they bee more in number then .90. then the ouerplus of .90. shall we be distaunt from the Equinoctiall, towarde the Pole where the Sunne declineth. And if they be iust .90., wee shalbe vnder the Equinoctiall.

When the sun hath no declinations.

When the Sunne hath no declination, we shal bee distaunt from the Equinoctiall the complement of the Meridian altitude, towarde the Pole where the shadowes are. By these rules (beside the vse whereof we haue spoken) may be knowne how much

is

is the greateſt declination of the Sunne, the altitude of the Equinoctial, the day, houre, and minute, when the Equinoy was: the which is knowne as followeth.

To know the greateſt declination of the Sunne.

Hauing taken the greater Meridian altitude of the Sommer (which is in the beginning of Cancer) and the leſſe of Winter, (which is in the begynnyng of Capricorne) takyng away the leſſe from the more, the reſt is that, that is from Tropike to Tropike, and conſequently parted by the middeſt, is the greateſt declination.

As for example, beeing in the Cittie of London I finde the greateſt Meridian altitude of the ☉ in the beginning of ♋ to bee 62. degrees, and the leſſer Meridian altitude, which is when the ☉ is in the beginning of ♑ to be .15. degrees, then taking .15. from 62. reſts 47. and ſo much is from Tropicke to Tropicke and the ½ which is 23 degrees. 30. minutes is the greateſt declination.

Againe the greateſt declination added to the leſſe Meridian altitude, or ſubſtracting it from the greater Meridian altitude, the reſt is the altitude of the Equinoctiall aboue the Horizon:

As for example: the greateſt declination 23. ½. added to the 15. the leſſer Meridian altitude makes 38. ½. or taken from 62. the greateſt Meridian altitude, reſtes 38. ½. the height of the Equinoctiall in the Citie of London, or in any place whers the Pole is eleuated 51. degrees 30. minutes: hereof it followeth, that when we take the Meridian altitude at 38. ½. that day is the true Equinoctiall which will be the eleuenth of march, and the thirtienth of September this preſent yeare 1596.

So likewiſe when you take the heyght of the Sunne vppon the meridian at 62. degrees of altitude, then is the Sunne in the true ſommer Tropicke: or at 15. degrees of the meridian altitude, then is the true Winter Tropicke: the Sommer Tropicke being at the Sunnes entraunce into ♋. and the Winter Tropicke, at the Sunnes entraunce into ♑ which is the twelfth of June and the twelfth of December this preſent yere 1596.

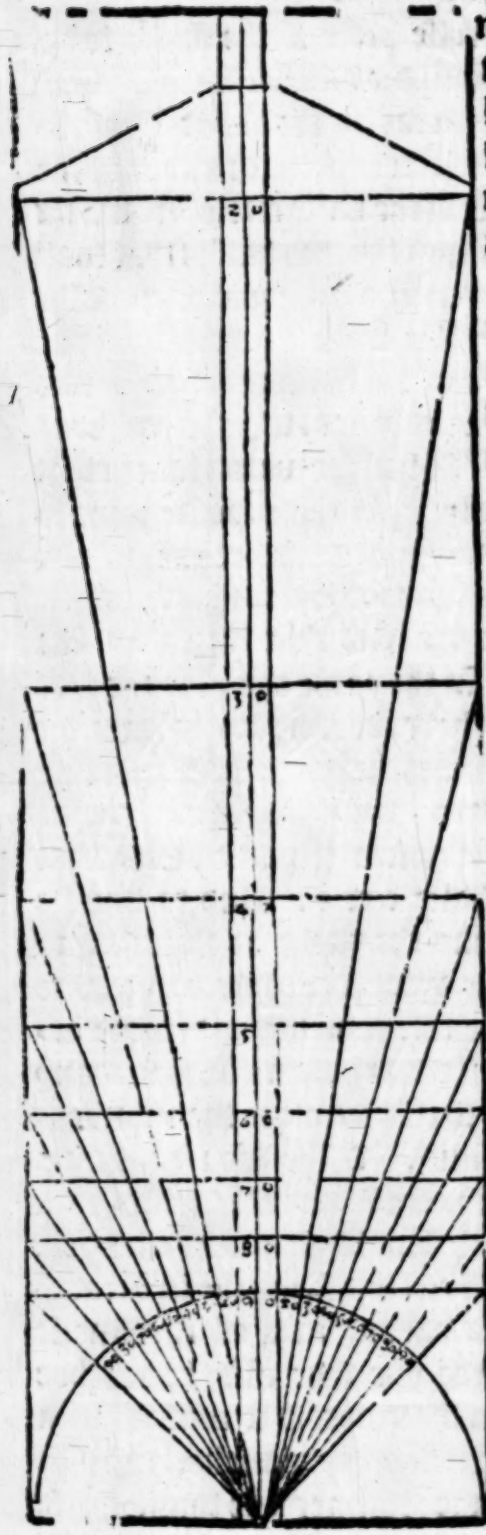
Here it is not vnnecessarie to be noted, that for the working and obseruing of these and such like prepositions, there is to be considered, that from the Equinoctiall to eyther of the poles, is iust 90. degrées, and the height of the pole, is the eleuation thereof: and hauing taken the height or altitude thereof, the same substracted from 90. that which remaineth is the eleuation, or height of the Equinoctiall aboue the Horizon: for it is certaine that if the Pole be taken at 90. degrées aboue the Horizon, that is to say: if the Pole be in the Zenith, then is the Equinoctial in the Horizon, and looke howe much the pole is depressed from the Zenith or verticall point, ouer your head, so much is the Equinoctiall raised aboue the Horizon towardes your Zenith, and by this reason you may knowe the Meridian altitude of the same, by adding the declination, with the eleuation of the Equinoctiall.

The ix. Chapter, of the making of the crosse staffe, wherewith the Mariners take the altitude of the North starres.

MAke a square staffe or yarde, of the thicknesse of a finger, more or lesse, according to the goodnes of the woode, and of length syxe spannes, or more. For the longer that it is, the more precise shall it bee, and the degrées shall bee the greater, whereby followeth the certainetie of the altitude. Then take a very plaine table of the length of the staffe, and two spannes of breadth, or at the least a spanne and a halfe: and in the middest of this Table, make a right line by longitude, and in the one ende of this line, make another lyne that may cutte it in right angles. And vppon the cutting of these two lines, put the foote of the compasse, and make halfe a circle, whiche may remaine on the parte of the long line, so that the halfe circle may haue so much Diameter, as you desire the

height

height of the hammer, head, or crosse peece of the staffe to be. This halfe circle being made, you shall drawe two lines, equidistaunt to the line which you haue made by the myddest of the Table. These lines must touch in the extremities or endes of the halfe circle. Then deuide euery halfe of the halfe circle, or quarter of the circle, into two equall partes, and the two halfes that shall end in the first line, deuide each of them into 90. equal parts. Thē take a ruler, and put the edge thereof vpon the center of the halfe circle, and vpon euery of the markes which deuide the 90. partes and so procēde, making punctes in the lynes, whiche you haue made equidistaunt to the firste lyne. Then drawe certaine right lynes, from the punctes of the one lyne, to the oppolite punctes of the other: and so shall the draught be ended. Then take ỹ staffe or yard, & put the one ende thereof in the center of the halfe circle, and apply the edge of the yarde to the lyne that goeth by the myddest of the Table: and marke in the yarde the markes that are in the sayde line, by meanes of the trauersing lynes, and see also that the markes which you make in the yarde, be trauersing lynes, and make them their numbers, beginning at the ende or poynt of the yarde that shall be to the contrarie parte, from that which you did in the puncte of the halfe circle. And to knowe with what degrées you shall beginne the yarde or staffe, and what number you shall marke in the firste line of the punct, loke howe many degrées are from the circle whiche you deuided betwæne the line that goeth to the laste marke, and with so many degrées enter, and so consequently shall you place the numbers from fiue to fiue, or from tenne to tenne. When you haue thus numbred the yarde, then to make the crosse peece thereof, take a table or planke of good wood, which shall be so much in length, as shall be the Diameter of the halfe circle, & so muche in breadth as thrée times the thickneſſe of the yarde, and of thyckneſſe two fyngers, or little lesse. On the one syde also it must bee very plaine, and on the other side in the myddest it must haue a square or quadrature of al the thyckneſſe of the plancke, and from the square to the endes, it must be made thinner and thinner, so that it hath in maner the fourme of such pickars wherewith



ake the
Totude ofn
altit ſtarre.

milſtones are picked. And in the myddeſt (by longitude and latitude) it muſte haue a ſquare hole, by the whiche the yarde may enter iuſt, and make right angles with the croſſe peece.

And the poynt of the yarde muſte enter by the playne ſyde of the croſſe peece, and come fooꝛth of the ſquare ſyde thereof. To take the altitude of the Nooꝛth Starre, oꝛ any other ſtarre on the Sea (foꝛ it ſerueth not on the Lande, noꝛ foꝛ the Sunne, except the Sunne ſhall be vnder any thinne cloude and the Hooꝛizon clears) you ſhall put the heade of the ſtaffe to the cooꝛner of your eye, rayſing it vp, oꝛ putting it doꝛwne, vntill the neather parte of the croſſe peece come with the Hooꝛizon: and being ſo, if the higher parte of the croſſe peece ſhall come with the ſtarre, you muſt looke the plaine ſide of the croſſe peece in what number of degrees of the ſtaffe it falleth, & thoſe degrees ſhall be the altitude of the Starre: as if the croſſe peece reache not to the Starre, you muſt bring the croſſe peece nearer to your eye, vntill the one parte thereof come wyth the Hooꝛizon, and the other wyth the Starre, and the degrees, whiche it ſheweth, ſhal be

the altitude.

The.x. Chapter, of the altitude of the Pole, knowen by the altitude of the North Starre.

TO knowe the paralell in the whiche the shyppe is, ouer and beside the rules, there before of the altitudes of the Sun, it is likewise knowne by the altitudes of the North starre. These two maners are vsed, for that more credite is giuen to two witnesses, then to one: So that if by one arise any doubt, the same may be certified by the other, and also because time may some time serue for the one, and not for the other: as, to haue a cloudy mirdad or noone and a cleare night.

The altitude is taken of the North Starre, which is a Starre in the extreamitie or ende of the tayle of the lesse Beare, being a constellation, commonly called the Horne. For this North Starre (of the most notable Starres about the Pole) is nearest vnto it, and shal therefore shew a lesse circle then any of the other, and so shall his altitude differ little from the altitude of the Pole. This Starre hath declination. 85 degrées, and 51 minutes, and the complement to nientie (which are foure degrées, and nientie minutes) is his distaunce from the pole. And although the Mariners holde oppinion, that it is not distannt more then three degrées and a halfe, yet to my iudgement, more credite ought to be giuen to the Astronomers, then to the Mariners, for as muche as the Astronomers do knowe the places of the Starres, with their longitudes, latitudes, declinations, and right assentions more perfectly and precisely then do the Mariners: For they accompt not onely by degrées, but also by minutes and secondes. But let none deceiue themselues through my opinion. Therefore whosoeuer will precisely knowe it, let him take the highest altitude of the North starre, which is his being ouer the Pole, and the lesse altitude, which is his being vnder it: then take away the lesse from the more, and the halfe of that, that remaineth, shall be the distaunce of that starre from the pole of the world.

The North starre.
The lesse beare.
The horne.
The distance of the North starre from the pole.

And likewise by this experience, may be knowen the altitude of the pole, and what all the other starres, that goe not down vnder the Horizon, bee distaunt from it. Joyning the greater altitude with the lesse, and that shall amount therof, deuided by the halfe, shalbe the altitude of the Pole: and taking away this altitude of the Pole, from the greater altitude of the Starre, or the lesse from the altitude of the Pole, the rest that remaineth, shalbe the distaunt of the Starre from the Pole. And as the Pole is inuisible, it cannot be seene or knowen, when the North Starre is hygher or lower, except it bee by the meane of some other marke: and for this is considered the position of the former Guards, or watch, being one of the two starres called the Guard, which are in the mouth of the Horne. The Mariners haue noted eyght positions from the former Guarde starre, to the North starre, which aunsweare to the eyght principall windes. And as the Guarde is to the North starre according to the placing of these positions, so shall it bee higher or lower from the Pole. Let vs here put the common rules which the Mariners vse, to comply with those that are of opinion of the three degrees and a halfe. And for the opinion of the Astronomers (which is the distance of 4. degrees and 9. minutes) I will hereafter giue a circuler figure with a mooueable horne: then the eyght windes of the eyght positions beyng marked, and putting the Guarde and the North starre in euerie of the windes, it shall be the distaunce that the North starre is higher or lower from the Pole.

The Pole is inuisible.

The two starres called the Guards of the North starre.

Commō rules of the Mariners differing from the Astronomers.

Common Rules.

These ruls after the Mariners accompt do hold, but not after the Astronomers accompt, as may appeare in the rules next before.

The former Guarde being in the East, the North starre is in one degree and a halfe vnder the Pole.

The Guard being in the Northeast, the North starre is three degrees and a halfe vnder the Pole.

The Guarde being in the North, the Starre is three degrees vnder the Pole.

The Guarde in the Northwest, the Starre is halfe a degree vnder the Pole.

The Guarde in the West, the Starre is one degree and a halfe aboue the Pole.

The Guarde in the Southwest, the starre is three degrees and a halfe aboue the Pole.

The Guarde in the South, the starre is three degrees aboue the Pole.

The Guarde in the southeast, the sayde North starre is halfe a degree aboue the Pole.

Note that these eyght wyndes, are made according to foure lynes. Whereof two are ryght, whiche are North & South, and East and West: and the other two are crooked which are Northeast southwest, and southeast Northweast. When the Guarde and the North starre shalbe in the ryght lyne, it shall appeare cleare how they are: and when they shalbe in the crooked lines, it may be seene, because the Guardes are the one by the other in a ryght lyne. The eight principall windes, according to foure lynes.

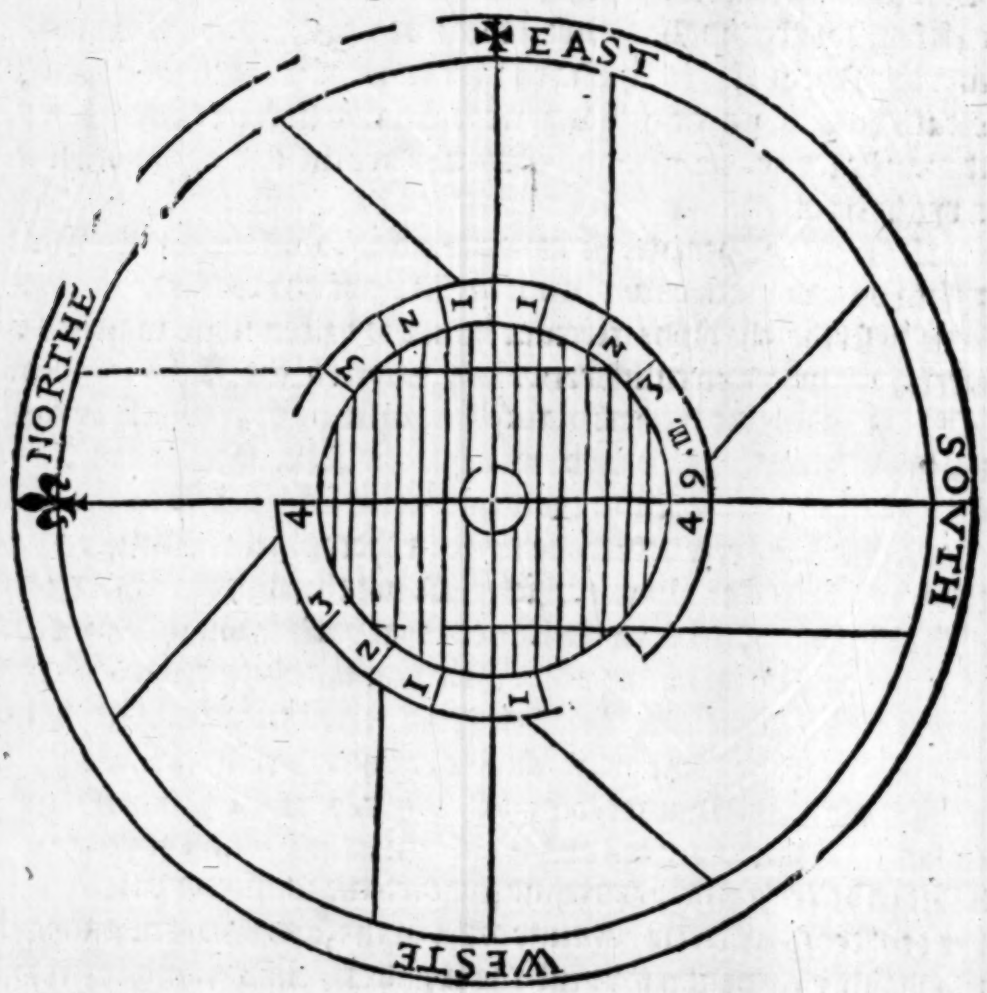
To see by Theorike or Speculation, how the North starre ryseth vp and goeth downe from the Pole of the worlde, I wyll here describe the sayde circuler figure or instrument, which is a circle, in whose circumference are wrytten the eight windes. The North in the highest place of the instrumēt, which they call the head, and the south in the neather part thereof, which they call the foote: the East in the ryght arme, the West in the left arme, the foure rest betweene these in their places. And heere is to be noted, that the lynes which passe not through the center, are of the wynded of their equidistances that passe through ỹ center. Within this circle, is an other litle circle, which describeth the starre of the North, by the mouing of the first mooueable, & hath for his center the Pole of the worlde, as hath the first. This litle circle as for his Diameter eyght degrees and eyghteene minutes: as foure degrees and niene minutes aboue the pole and deuided by certeyne lynes equidistant to the East and West. In the center of this circle, is annexed a horne, with his seuen starres, mooueable rounde about by all the wyndes. And seeing them in heauen, how, & in what winde they are, euen so in this figure shal we see the North starre, in what part it is of the degrees, hygh or lowe from the pole: & that the Pilot or Mariners shall not erre, I say that he ought not to put the foreguarde in the windes that passe An instrumēt to know the rysing or falling of the North starre: from the pole of the world.

The horne of the seuē starres

Aduertisemēt to Mariners in vsing the figure following.

passe through the center of the figure, for it shalbe North and South with the pole, and not with the starre of the North, as it ought to be, and so of the other wyndes. And in this maner the starre of the North, shal shewe in the lynes equidistant from the lesse circle, the degrees and partes of the degrees that it is higher or lower than the pole of the world: for the same course, differences, and variations, it maketh in heauen.

This figure is after the Astronomers, which affirme that the north star is foure degrees, & niene minutes from the pole.



The altitude of the pole, aboue the Horizon.

Thus beyng knowne howe much the North starre is vnder or aboue the pole, let vs take the altitude thereof: and that of it that is vnder the pole, let vs ioyne to his height, and as muche of it as is aboue, let vs take away, and that shall ryse thereof, shal be the altitude of the pole aboue our Horizon.

The

The. xi. Chapter of the compoſition and vſe of an inſtrument, by the which wihout obſeruing the South Sunne, or mydday, is knowne the altitude of the pole, and the houre that is.

WE haue giuen rules, whereby the Pilotte may knowe in what paralell hee findeth himſelfe with his Shyp. But he may not knowe this at all houres, for as muche as for the altitudes of the Sunne it is neceſſarie to obſerue the mydday iuſtly, and for the altitudes of the North, it is neceſſarie to obſerue, that the foremoſt guard be placed iuſtly with the North in ſome of the foure lynes of the eyght windes. And ouer and beſide the rules aforeſayde, I haue thought good to deſcribe an inſtrument, by the which may be knowne the paralel where the Shyppe is, and what the houre is at any time of the day by the beames of the Sunne.

An inſtrument to know the paralel and houre by the ſunne.

Make a round plate of Laton, or other conuenient mettall, of the Diameter of a ſpanne, or more: For the greater that it is, the more preciſe ſhall it be: and make in it two Diameters, that may cutte them ſelues in right angles vpon the center. In the foure extreames or endes of theſe Diameters, leaue foure rounde punctes or poyntes, that may ſerue for aris. The one of theſe Diameters, ſhalbe called the aris of the world, and the other, the lyne of Eaſt and Weſt. This doone, make of the ſame laten or ſemicirculer peece, of the thyckines of the plate, or litle leſſe, and of the breadth of halfe a finger: this muſt ſtande vpon an edge, ſo that the conuex part may come iuſtly with the halfe of the circumference of the plate, to the which it muſt bee nayled or ſothered in the neather part of the plate, the ſemicircle being rayſed, & that the endes thereof may come with the endes of the aris of the world. And this ſemicircle ſhall you diuide into two equall partes, and euery halfe into. 90. degrees, begynnyng from.

from the halfe point toward the ende of the Axis of the woꝛlde, which are the Poles.

In like maner shall you make two circular peeces, of the bigneſſe of a peece of foure royals of plate, which they call rundels, foꝛ the houres: theſe muſt be made faſt in the plate by the Poles of the woꝛlde, whiche may holde oꝛ beare them by theyꝛ centers. And euery of theſe rundelles muſt be deuided into .24. equall partes, and although not al, yet the vppermoſt part of the plate. And aboue in the higheſt poynt of theſe diuiſions, you muſt wꝛite 12. becauſe that there it ſhall ſhew the mydday oꝛ noone: and frō thence, the afternoone houres muſt begin their numbers toward the Weſt part, and ſhal ende. 6. houres in the halfe oꝛ myddeſt of the ioynt of the circle with the plate. In the other ioynt of the other part, ſhall begin. 6 of the houres beſoꝛe noone & ſhal ende 12. in the higheſt poynt. You muſt alſo make an other Semicirculer peece, of the bꝛeadth of a finger, this muſt be playne oꝛ flat, and the concauitie oꝛ hollowneſſe thereof, equal to the Semicircle of the edge oꝛ ſyde of the plate, and in the endes muſte haue two holes, wherein may iuſtly enter the poyntes that come fooꝛth of the circle, foꝛ the houres, which are the Poles of the woꝛlde. Alſo, this Semicircle, muſt haue two lynes one on the vppermoſt part, and the other on the neathermoſt, whiche may deuide the bꝛeadth into two equal partes. This halfe circle likewiſe muſt be deuided into two equall partes by longitude with a trauerſed lyne, which ſhalbe called the Equinoctiall, & from thys lyne, to the inwarde part thereof, muſt be counted .13. degrees and a halfe towarde the one parte, and as much towarde the other parte of the. 90. that euery halfe of the circle conteyneth. And at euery parte where end the .23. degrees & a halfe, make a trauerſed lyne, ſo that from the one to the other, may be. 47. degrees. And in thys ſpace ſhall you dꝛawe certeyne lines equidiſtaunte with them of the myddeſt, that they and the myddle lyne, may deuide into .4. equall partes the bꝛeadth of the halfe circle. Then looke in the table of the declinations of the ſunne, what declination hath the .5. degree of Aries, and that ſhall you account from the Equinoctiall towarde the one parte, and

as

as muche more towarde the other, makyng a lyne that may trauerse that of the myddest, where that declination doeth ende and touch in the other two lynes. And the same shal you doo at. 10. 15. 20. 25. and. 30. which is the ende of Aryes, and begynnyng of Taurus: & then the line shal trauerse all the breadth. The like also shall you doo to Taurus and Gemini, then in the spaces wyte Caracts of the .xii. signes, begynnyng Aries from the Equinoctiall, towarde the North Pole. And then doo Taurus and Gemini ende in the greatest declination, beginnyng Cancer in the other part of it. Then Leo and Virgo doo ende in the Equinoctiall, where shall begin Libra, Scorpio, Sagittarius: and in the other parte, Capricornus, Aquarius, and Pisces, shall ende in the Equinoctiall where Aries began. This halfe circle must haue an opening, or open place, euen and inlt in the myddest from the Equinoctiall, vnto some what more then the greatest declinations, and must bee a little broder on the inner parte, then without: and not so brode as may come to the two lynes, because it would then take away the gradation of the signes. And in this open place must be put a square grayne or stubbe, which on the inner parte may come playne with the halfe cycle, and the vtter part may come forth a little, where shalbe nayld a square peece of Laton, of the breadth of the halfe cycle. This graine or stubbe being so nayled with a peece, must haue in the middest a hole, so small, as may receiue a lyttle pinne, and by the center of this hole, must passe a lyne, which shall trauerse all the grayne. And this lyne shall serue to put the sunne (which the hole representeth) in the degree of the signe where it is. This halfe circle where it goeth in the circumferences of the rundels for the houres, must be syled on the one side vnto the lyne that is in the myddest, to marke it, and shew the number of it. For the placyng or settyng of this instrument, you must cut a gyrdle or ryng of laton, as thicke as the plate, and of the breadth of a finger, or lytle lesse: and so large, that of it may bee made a circle some what bygger then the plate, so that the plate and the Meridian may easily be conteyned within it. This circle shal be called the Horizon, which must be deuided into foure quarters.

The Caracts of the .xii. signes.

The hole that representeth the sunne.

The placing or setting of the instrument.

In like manner must be made two semicirculer peeces, & the

ends

endes of them muſt be nayled or ſothered in the pointes that deuide the quarters of the circle: and deuide the one from the other in two equall partes, making right ſpericall angles And in this ioynt of theſe two peces, muſte bee nayled or ſothered a Paſtel, the which at the one ende is deuided into two braunches or forkes. Then ſhall you make a baſe or foote for the ſame, whiche in the vppermoſt parte thereof ſhall haue a concauitie or holownelle, where may be ſet a ſayling compaſſe or a needle, touched with the Lode ſtone, and couered ouer with a glaſſe. And on the higheſt edges of this baſe, the two braunches of the Paſtel ſhall be made faſte: and this baſe, with the Paſtel, the halfe circle, and the circle, ſhall be all one peece, which ſhall be called the ſeate or frame of the inſtrument. The Horizontall circle in the endes of one halfe circle, muſt haue two holes, in the which may enter the Axis that are made in the endes of the line of eaſt and weſt.

The foote or baſe of the inſtrument.

Alſo you muſt take good hede when you ſother or make faſt the Paſtel in the baſe, that the North and South of the plate or Horizon, come with the North and South of the needle that is beneath, hauing euer reſpecte howe muche the needle dooth vary from the Meridian, by Northeaſting or Northweſting. In the ioynt of the two halfe circles vpon the Paſtel, muſte be a point (called the inder or ſhewer) which ſhall ſhewe in the halfe circle, ſothered in the place on the neather part, the degrees that the pole is rayſed aboue the Horizon.

The index or ſhewer.

For the perfection of this inſtrument, it ſhall be conuenient to ſet the Horizon very playne and equall at the time of the operation or practiſing with the inſtrument, and this may be done in two maners. Whereof the one is, hanging by a fine threde, at the center of the plate, a plomet made ſomewhat poynted at the neather ende: ſo that the Horizon ſtanding plaine and leuel, the point of the plomet may fall vpon the point of the inder, and this maner is good for the lande. But for the Sea, you ſhall ſother the Horizon two Axes, little ſtubbes or endes comming forth. Theſe ſhall be put in the two oppoſite holes of a circle of mettall made ſomewhat ſtrong, and this circle muſt haue other two ſtubbes lykewyſe comming forth, and equally diſtaunt from the two holes. Theſe muſte bee ſothered or nayled in two

The placing of the Horizon.

For the land.

For the Sea.

holes

holes of another circle in like maner, and the other circle wyth other two stubbes, inclosed in a bore. If then the bore stande euen and leuel, the poyse or wayght shall cause the Horizon to stande leuel, although the shyp sway or route from side to side. The vse of this instrument is in this maner.

The vse of the instrument.

When you desire to knowe the parelel in whiche you are, and the houre that is, put the lyne that trauerseth the graine, in the degree of the signe in the which the Sunne is (which you shall knowe by the table of the place of the Sunne, in the second Chapter of the seconde parte) and set the North and the South of the plate, with the North and South of the needle. Then turne the moueable Meridian against the Sunne, the foote of the instrument standing fast, and raise it, or put it downe in a plate, vntill the beame of the Sunne enter in at the hole of the graine, and fall in the center of the plate, and standing so, beholde the inder, and howe many degrees it sheweth from the Meridian, so muche is the altitude of the pole. Then loke where the moueable Meridian sheweth in the rundel of the houres, & there shal you se the houre that is.

The altitude of the Pole.

Here followeth the demonstration

The .xii. Chapter, of the leagues that are runne for a degree, according vnto diuers courses.

IN the firth Chapter, I promised to giue a rule to knowe the distaunce from one paralel to another, sayling by whatsoeuer lyne or winde, except the East and West: for the which is to be vnderstood that the Nauigation or course from one place to another (according to the Cosmographers) ought to be by the arke of the greater circle, for that by this manner shalbee the shortest course, and this greater circle they deuide into .360. degrees: and all the distaunces that are from one place to another, they account by the degrees and minutes of this cycle: and so sayling from North to South, to one degree of the variation of the height of the Pole, shall aunswere another degree of the greater circle in the superficiall part of the water and lande. And therefore sayling by whatsoeuer other lyne, vntyll the Pole dooth vary one degree of altitudes, we shall haue gone more then one degree of the greater cycle: the degrees that aunswere to euerie lyne or winde, you shal see in the demonstration following, which hath two paralell lynes, which are East and West, and ỹ lyne that cutteth them in right angles, which commeth foorth of the center, from the quarter of the circle that is made, is North and South, and then shall you see by this order, all the other winds, halfe windes, and quarters of windes, reduced to one quarter: For the selfe same account serueth for Northeast and Southwest and Northwest and Southeast, and so of the halfe windes and quarters of windes that are equally distaunt from the lyne of the North and South: and so this quarter shall serue for the .32. windes of the compasse. Without this quarter, harde by the lyne, you shall finde two numbers, whereof the first shalbee of the degrees, and minutes of degrees of the great circle, which is from one paralell to another.

To know the distance from one paralel to another.

The arke of the greater circle.

The altitude of the pole varying one degree.

The quarter seruing for the 32. winds of the cõpasse

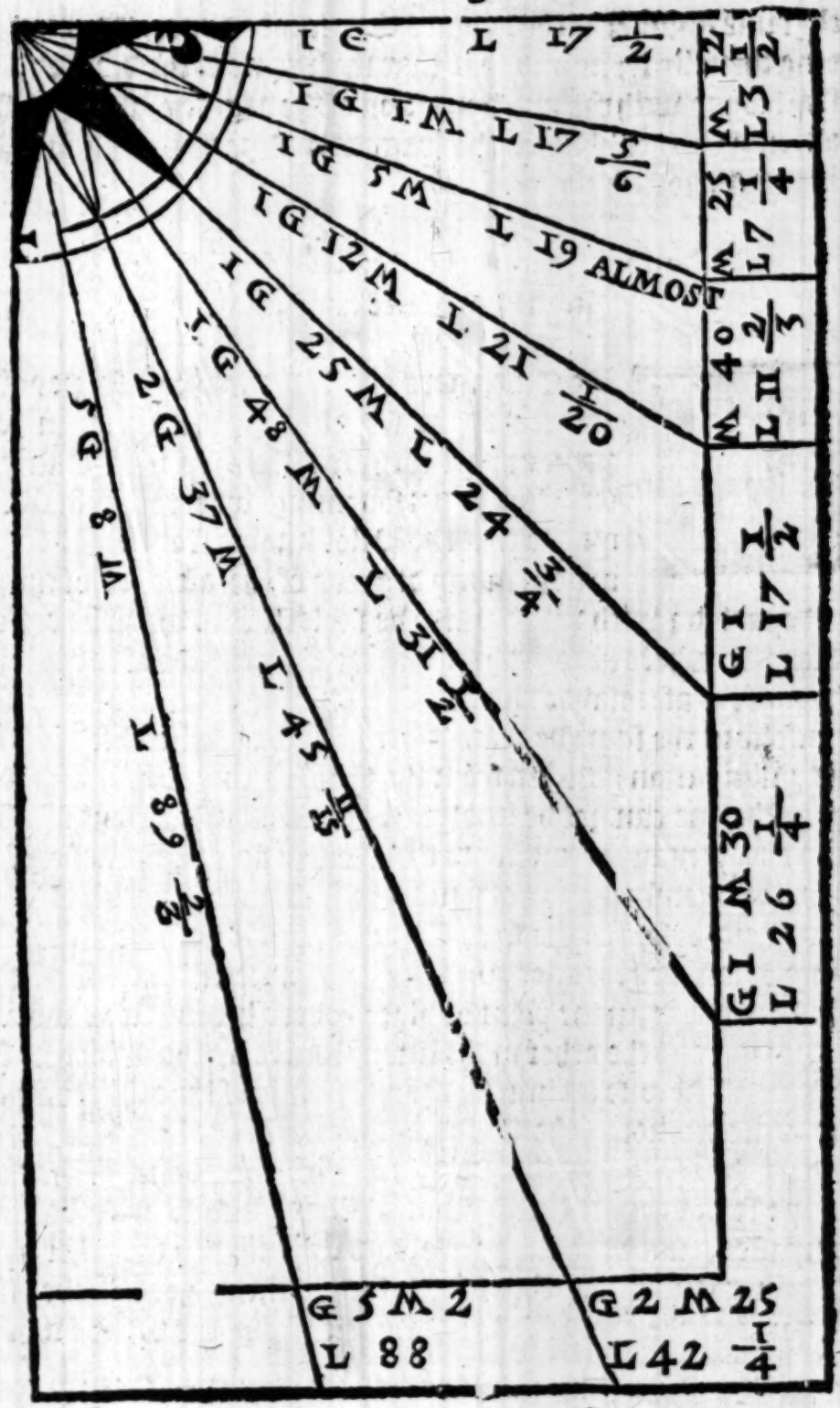
The other number, shalbe the leagues, and parts of leagues that such degrees and minutes do amount vnto, after the rate of .17. leagues and a halfe for a degree. In like maner in the paralell, where the lynes of the windes do concurre, shalbe set ioyntlie to euery lyne the degrees and minutes of the distance from the lyne of North and South, and leagues & partes of leagues that such degrees and minutes amount vnto: and so it is, that sayling by the lyne, winde, or point of North and South, vntyl the altitude of the pole vary one degree, is run another degree, which conteyneth leagues .17. and a halfe: and by the next line, for one degree of the variation of the altitude of the pole, is run one degree, one minute .17. leagues & .5. fyue partes: and they that runne vpon that lyne or point, depart from the lyne of North, and South, or Meridian lyne .12. minutes, leagues .3. and a halfe. By the seconde lyne, is runne one degree, 5. minutes, and leagues .19. scant, and in this course, they depart from the Meridian .25. minutes, leagues, 17. and a quarter. By the thyrd lyne is runne one degree .12. minutes, leagues .21. and .20. part of a league, and depart from the Meridian lyne .40. minutes, leagues .11. and two terces. By the fourth lyne, is run one degree, minutes .25. leagues .24. and three quarters, and depart from the Meridian, one degree iustly, leagues .17. and a halfe. By the fifth lyne, is runne one degree, minutes 48. leagues .31. and a halfe, and depart from the lyne one degree .30. minutes, leagues .26 and one quarter. By the sirth lyne, is runne two degrees, minutes .37. leagues .45 and of the .45 partes of one league, the .11. parte, and depart from the lyne two degrees, minutes, 25. leagues 42. and a quarter. By the seuenth lyne, is runne fyue degrees, minutes .8. leagues .29. and two terces, and depart from the line fyue degrees, minuts .2. which are leagues .88. accounting .17. leagues and a halfe for a degree of the greater circle. And if for euery lyne you desire to know this computation of leagues, after .16. leagues and two terces for a degree, or for more or lesse leagues or myles, multiply those such degrees by the number of the leagues or myles which enter into euery degree, & lykewise shall you number the minutes that are more then the degrees, by

One degree of variation of the pole.

Departing from the Meridian lyne.

Degrees of the greater circle.

the


1 G L 17 1/2
1 G 1 M L 17 5/6
1 G 5 M L 19 ALMOST
1 G 12 M L 21 1/20
1 G 25 M L 24 3/4
1 G 48 M L 31 1/2
2 G 37 M L 45 11/15
5 G 8 M L 89 2/3
G 5 M 2 L 88
G 2 M 25 L 42 1/4
12 1/2
M L3 1/2
M 25 L7 1/4
M 40 L11 2/3
G 1 L 17 1/2
G 1 M 30 L 26 1/4

the same number of the leagues that enter in euery degree, deuiding them by syxtie and that that shall come of the diuision, you shall ioyne with the multiplication of the degrees, and that shall amount thereof, shalbee the leagues, and partes of leagues, that was in those such degrees.

The .xiii. Chapter, how to set or make a pricke in the Carde of Nauigation.

To knowe in what part or point the ship is.

THe Marriners call the pricking of a poynte in the Carde, to see and appoint in it, in what point or part of the sea, the shyp is in Nauigation. For the performing whereof, it shalbe requisite that the Pilot knowe from what degrée, or how many degrees of the altitude of the pole he departed & with what winde he sayleth. And when he desireth to knowe where he is, let him knowe the altitude of the pole, by some of the aforesayde rules. And if (taking the altitude) he finde himselfe in the same degrees where he was when hée departed, his Nauigation hath bin from the East to the West, and what he hath gone can not be knowne but by the iudgement of a wise and expert man, according to the swiftnesse or goodnesse of his shyp, with consideration of ỳ more or lesse time he hath had, as we haue sayd before in the sixth Chapter. But if he finde himselfe in more or lesse degrees, let him take two payre of compasses, & put the foote of one, in the point or place where his ship was when he departed, and the other in the line or winde by the which he sayleth, and likewise let him set the one pointe of the other compasse in the graduation of the Carde, in that number of degrees that he findeth the altitude of the Pole, and the other point of the same compasse in the next line of East & West: and so with both the compasses, one in the one hande, and the other in the other hand, let him goe ioyning them togeather, taking good heede, that the point of the compasse do not swarue from the wynde whereby he hath sayled, neyther the point of the other compasse from the lyne of East and west, where he set it.

The altitude of the Pole.

To finde the distaunce by the Carde.

And

And following those two compasses by these two lines, vntyll the poyntes of the two compasses ioyne (that is to meane, the poynt that was set in the place from whence he departed, and the other that was set in the degrees that were founde) then where these two pointes do ioyne, is the point where the shyppe is. But (as we haue sayd in the sixth Chapter) they must haue great respect to the windes and seas, and other thinges whiche experience sheweth them, to knowe if they haue gone directly by that lyne, or if they haue fallen from it, and to what part: the whiche I remit to the iudgement of men of good experience. From thence forwarde, they shall returne to keepe the same account, as when they departed from the hauen, especially when they chaunge their course.

Aduertisements to the Pilots

The. xiiii. Chapter, of the makyng and vse of the Instrument generall, to knowe the houres and quantities of the day, and at what wynde the Sunne riseth and falleth.

MAke a rounde plate with a ryng or a handle aboue, as in the Astrolabie, drawing a lyne from the ring downwarde passing through the center, and another lyne that may cut it in ryght angles through the center: and this last lyne shalbe called the Horizon. Then shall you giue a circle vpon the center, leauing so much space betweene it and the edge of the plate, that therein may be written the numbers of the degrees: then also make another circle some what more within, leauing lykewyse a space where the graduations may be deuided. This done, deuide one of the highest quadrantes towarde the left hand into. 90. partes, which shalbe called the degrees of latitude, beginning the number of them from the ryng, & ending the same in the Horizon. Then make another rundell somewhat lesse then this, in such maner that the degrees & numbers of the greater, remayne vncouered.

And deuide this lesse, by two Diameters into foure equal parts. And at the one ende of the one Diameter, leaue a poynt cõming foorth of the lesse rundel, cut directly with the same Diameter by the one part, and this shalbe called the inder or shewer. In this rundel you shall make a circle halfe a finger lesse then the rundel. Then with a compasse take .23. degrees and a halfe from the Diameter, whiche signifieth the Equinoctiall: and where as end the .23. degrees and a halfe, for euery part make a ryght lyne from one point to another, so that this be a lyne of 47. degrees, and as muchs more at the other ende of the sayde Equinoctiall. Upon euery one of these right lynes, you shall make a halfe circle, and deuide euery of them into syxe equall partes, which may aunsweare to syxe signes, and euery signe into three partes, which may aunsweare to the tenthes or tenth partes of degrees: and yf the instrument be great, you shal deuide euery signe into fiue or moe partes, so that you may make it perfect and precise. This doone, from the pointes or prickes of the one halfe circle, to the pointes of the other, draw certeyne lynes whiche shalbe equidistaunt to the Equinoctiall. In the endes of these lynes, betweene the lesse circle, and the edge of the rundel, draw also certeyne lynes, whiche may reache vnto the begynnynges and endes of the signes: and in the toppe of the endes, or ouer the endes of these lynes, make an Arke, so farre distaunt from the lesse circle, as is the thickneſse of the edge of a peece of foure royals of plate: and in the space that is left, graduate the signes from tenne to tenne, or as the diuision shalbe. The space that remayneth from thence to the edge of the rundel, you shall deuide by the halfe, and in it shalbe made twelue spaces, where you shall set the signes with theyr names or caracters orderly, so that Aries bee next vnto the Equinoctiall, then Taurus towarde the parte of the Inder, then Gemini: and turning towarde the Equinoctiall, Cancer, Leo, Virgo. Lykewyse on the other parte of the Equinoctiall, Libra, Scorpio, Sagittarius. And turnyng to the Equinoctiall Capricornus, Aquarius, Pisces. And thus hauyng signed the Zodiacke, you shall also signe or marke the houres in maner as followeth.

The placing of the twelue signes in the instrument.

The zodiack.

Deuide

Deuide the lesse circle of this rundel into foure equall partes, so that euery quarter may haue sixe partes. Reduce this deuision to the Diameter, puttyng the ruler vpon the pointes, equally distant from the Horizon. And where it toucheth the Equinoctiall, make prickes or poyntes, so that the Equinoniall remayne deuided into twelue partes. Then vpon one of the Tropykes giue a circle, which may haue the same Tropike for his Diameter. Deuide this circle into. 24. equal partes, & reduce these diuisions to the Tropike, as is doone in the Equinoctiall, & from one Tropike to another: then the Equinoctiall, and the Tropikes being thus deuided with these prickes or pointes, you shall passe with a payre of compasses by euery poynt equally ordered from the Horizon, to the one and the other parte, and these shalbe called houres, wryting in the endes of them theyr numbers, beginning the one part in one, and ending it in twelue. On the other part, begin the one in the opposite part, and end in twelue. This done, these rundels shalbe brought to their perfection. Moreouer, you shal make a triangle, with a ryght angle, hauing two equal sides that may make the ryght angle. Euery of these sides must be as long as is the Semidiameter of the greatest rundel: also, vpon and about the ryght angle, you shall make a little circle, which shall haue the same angle for his center, & on the one side of this tryangle, set two raysed plates, as in the Astrolabie: on the contrary side of these raysed plates, must be a hole, so farre distaunt from the center or angle, as is the Semidiameter of the circle of the lesse rundel. In this hole you must put a threede, hangyng thereat a litle weight or plommet, onely sufficient to holde the threede straight, so that it cause nothing of the rundels to turne, or the instrument to decline. Furthermore, in a circle as bigge as the lesse of the lesse rundel, you shall deuide into. 32. partes the ryght wyndes, and halfe wyndes, and quarters of windes. And being thus reduced to their Diameters (as is doone in the Equinoctial) you shall translate them in the sides of the triangle, in the which by the center of his litle circle, and by the center of the rundels, all the three peeces must be made fast with an ares or a nayle, so that they may be turned about close and very iuste. Then put a ryng in the handle of the instrument, wherby it may

Diuision of the Equinoctial and Tropikes.

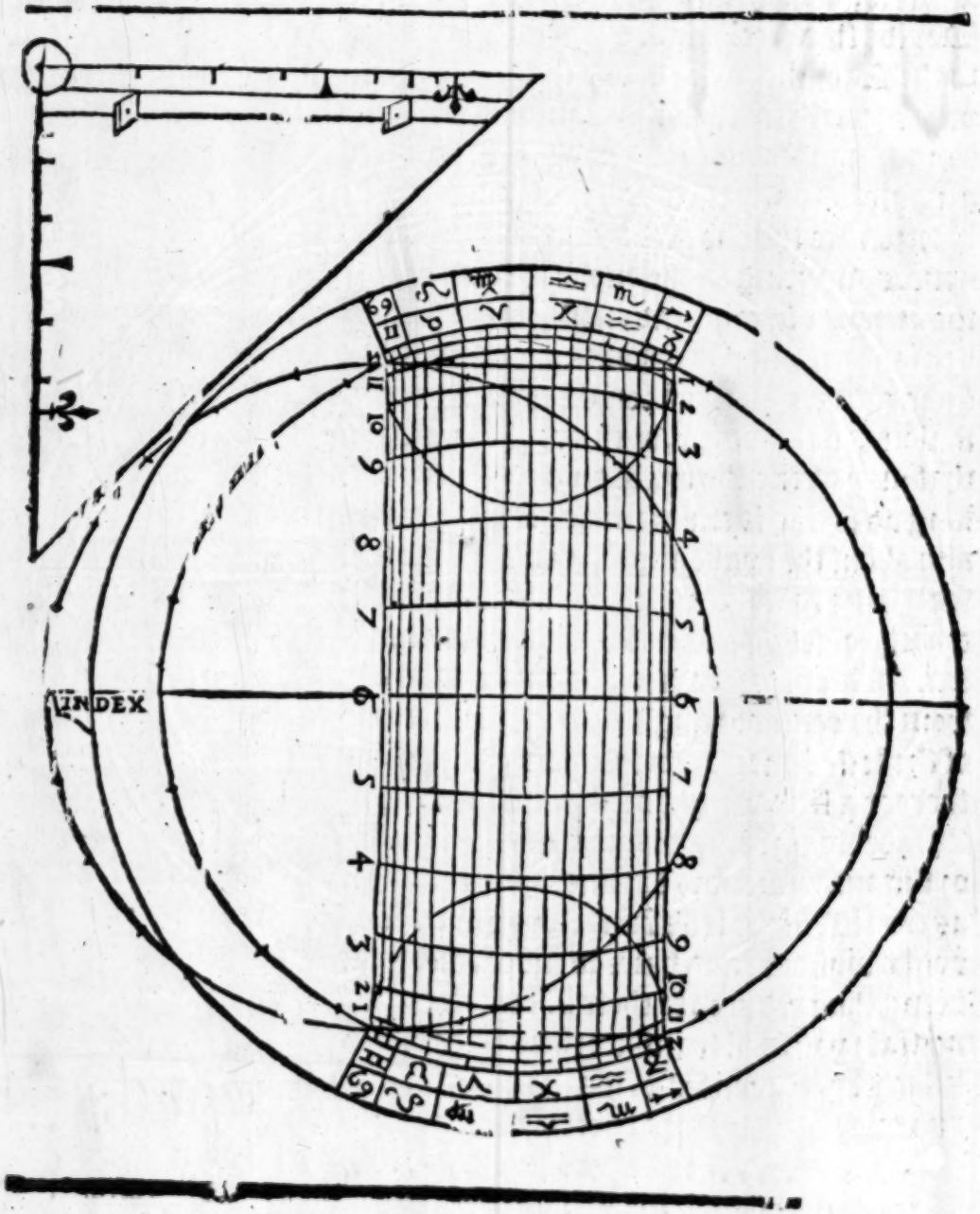
The houres with their numbers.

The triangle.

Diuision of the windes.

hange, as in the Astrolabie: and so shall the instrument be fynished and brought to perfection.

This is the trace or draught of the Instrument.



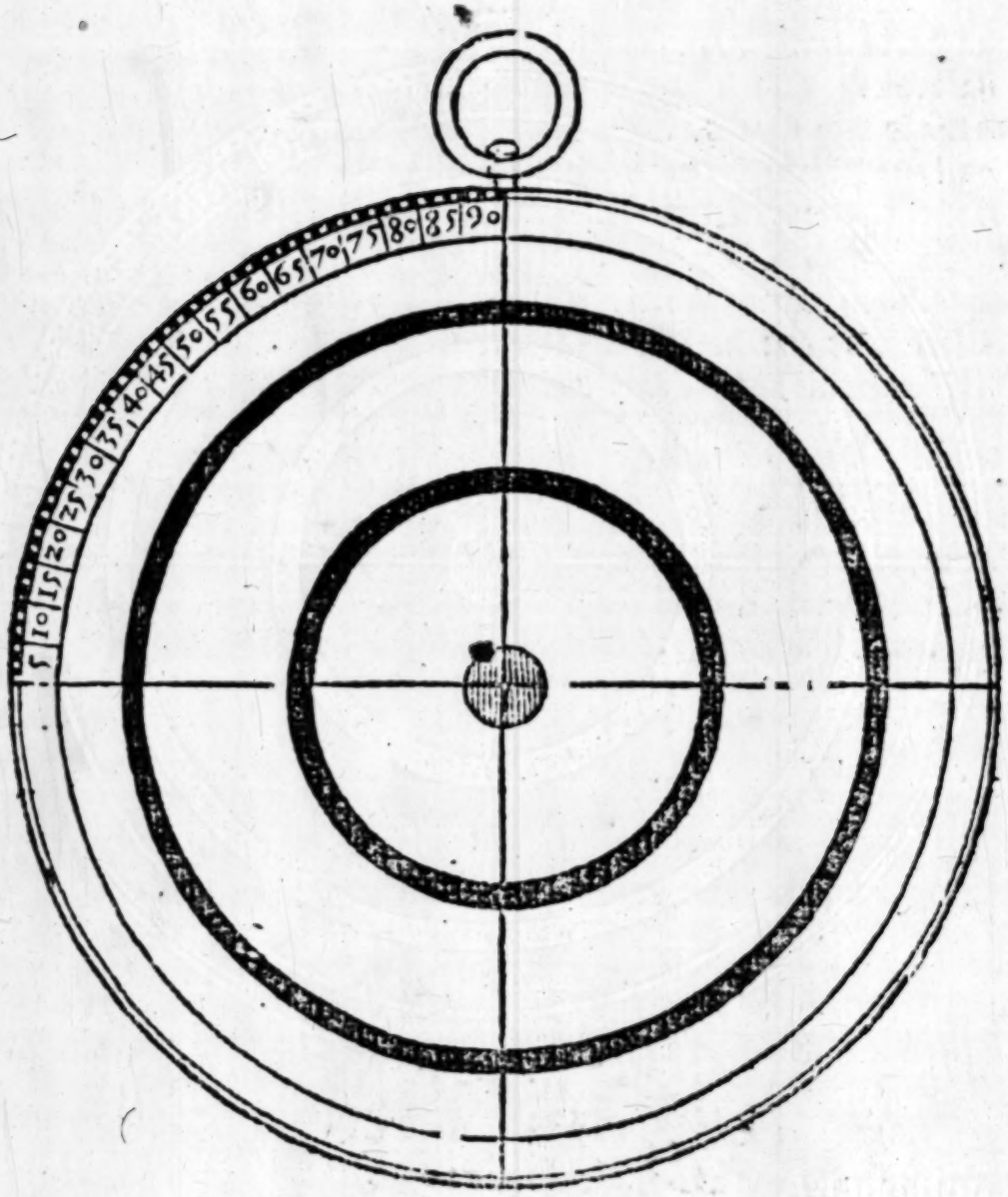
To knowe what houre the Sunne ryseth and falleth (by the Instrument following) you shall put the Pole of the lesse rundel (which is the inder) to the left hand in the greatest rundell, in so many degrees aboue the Horizon, in howe many degrees the Pole is rayſed in that lande or place. Then put the triangle, (which is the Horizon) in his place: that is to say, if the Sunne shalbe in the North signes, put it to the left hand: and if it shalbe in the South signes, to the ryght hand, and then the triangle shall cut the paralel where the Sunne goeth, in. 10. or 20. or 30. degrees, or proportionally where it is, and there shall you see in the sydes of the Zodiacke, the houres when the Sunne riseth and falleth. And lykewise at what winde the Sunne riseth and falleth to vs, you shall see in the windes of the triangle.

To know at what houre the sun riseth or falleth.

To knowe by the eleuation of the Sunne, the houre that is, put the Pole or Inder so farre distant from the Zenith or handle of the Instrument, as it is in that place or paralel aboue the Horizon, then turne the triangle towarde the Sunne, vntyll the beames thereof enter in at the rayſed plates, and then the threede with the plomet, shall cut the paralell of the Sunne, by the houre that shalbe: and consequentlie the triangle shall be distaunt from the Zenith the degrees that the Sunne shalbe rayſed that houre aboue the Horizon.

At what wind the Sunne ryseth or falleth

This is the Demonſtration.



An addition

An addition to the arte of Nauigation.

The first Chapter, sheweth the declination of the Sunne for euery month and day of the month througout the yeare.

KNowing the great vse, necessitie, and benefit, which doth abound to all Seafaring men, by hauing knowledge what declination the Sunne makes, from the two Equinoctiall pointes. Viz. ♈ & ♎. towardes eyther of the Poles, that is to say, North or South, as also considering that the table to the same purpose set downe before in the third Chapter of the seconde parte (because it is Calculated, but only for the degrees of each signe of the Zodiack) is somewhat troublesome to finde, because the true place of the Sunne is required, and then to worke by the rule of proportion, whiche euery one cannot doo, or at the least wise cannot at all times haue so much leasure, therefore I say: for the more ease and ready finding of the afore saide declination, I haue here gathered a regement or table, according to the best and truest calculaters, who in these dayes finde the greatest ertention or declination of the Sunne, to be from the Equinoctiall towards either of the poles 23. degrees 28. minutes, which greatest declynation or distaunce, are called the tropicall pointes of ♋. and ♑. vnto which pointes, the Sunne by his continuall mouing in the zodiack hauing attained, returneth againe to the Equinoctiall, descending by the same proportion of time, as hee ascended, and so from thence to the contrarie Tropicke, thereby making the beginnings of the foure principal times, or quarters of the yere, that is to say: Winter, the Spring, Sommer, & Autumne or Haruest the chiefe vse of which tables are to finde the eleuation or height of the Poles aboue the Horizon, in any place whatsoeuer, being calculated for foure yeares viz. the leape yeare, & the first, seconde and third after the leape yeare, beginning at this present yeare of 1596. being leape yeare, & may serue at the least for 20 yeres without any notable errour.

The vse and working whereof followeth after the said tables.

Januarie.

Leapyeare.			First.			Second.			third		
4			1			2			3		
1596			1597			1598			1599		
1600			1601			1602			1603		
1604			1605			1606			1607		
1608			1609			1610			1611		
1612			1613			1614			1615		
D	G	♑	D	G	♑	D	G	♑	D	G	♑
1	21	57	1	21	50	1	21	52	1	21	56
2	21	47	2	21	40	2	21	34	2	21	45
3	21	36	3	21	30	3	21	33	3	21	30
4	21	25	4	21	20	4	21	23	4	21	26
5	21	15	5	21	9	5	21	13	5	21	15
9	21	5	6	20	59	6	21	0	6	21	4
7	20	54	7	20	48	7	20	50	7	20	54
8	20	43	8	20	36	8	20	38	8	20	41
9	20	31	9	20	23	9	20	26	9	20	29
10	20	20	10	20	10	10	20	15	10	20	16
11	20	6	11	19	59	11	20	0	11	20	3
12	19	52	12	19	43	12	19	47	12	19	53
13	19	35	13	19	30	13	19	33	13	19	39
14	19	23	14	19	14	14	19	19	14	19	25
15	19	7	15	19	0	15	19	4	15	19	12
16	18	54	16	18	45	16	18	49	16	18	56
17	18	39	17	18	29	17	18	34	17	18	41
18	18	23	18	18	14	18	18	16	18	18	26
19	18	8	19	17	58	19	18	2	19	18	11
20	17	52	20	17	42	20	17	46	20	17	54
21	17	36	21	17	25	21	17	32	21	17	38
22	17	19	22	17	8	22	17	12	22	17	21
23	17	4	23	16	51	23	16	56	23	17	4
24	16	45	24	16	32	24	16	38	24	16	47
25	16	28	25	16	16	25	16	21	25	16	29
26	16	10	26	15	57	26	16	3	26	16	12
27	15	53	27	15	39	27	15	45	27	15	49
28	15	33	29	15	21	28	15	26	28	15	30
29	15	15	29	15	2	29	15	7	29	15	12
30	14	56	30	14	43	30	14	48	30	14	53
31	14	35	31	24	24	31	14	29	31	14	34

South declination.

South declination.

South declination.

Februarie.

Leap yeare.			First.			Second.			third		
4			1			2			3		
1596			1597			1598			1599		
1600			1601			1602			1603		
1604			1605			1606			1607		
1608			1609			1610			1611		
1612			1613			1614			1615		
D	G	M	D	G	M	D	G	M	D	G	M
1	14	19	1	14	4	1	14	10	1	14	14
2	14	0	2	13	44	2	13	50	2	13	54
3	13	40	3	13	24	3	13	30	3	13	35
4	13	20	4	13	4	4	13	9	4	13	16
5	13	0	5	12	43	5	12	49	5	12	57
6	12	40	6	12	23	6	12	29	6	12	34
7	12	19	7	12	2	7	12	8	7	12	14
8	11	58	8	11	41	8	11	47	8	11	52
9	11	37	9	11	20	9	11	26	9	11	32
10	11	16	10	10	58	10	11	4	10	11	12
11	10	55	11	10	36	11	10	43	11	10	50
12	10	30	12	10	15	12	10	21	12	10	28
13	10	10	13	9	53	13	9	59	13	10	6
14	9	49	14	9	31	14	9	37	14	9	43
15	9	27	15	9	9	15	9	14	15	9	21
16	9	5	16	8	47	16	8	50	16	8	58
17	8	43	17	8	24	17	8	28	17	8	36
18	8	21	18	8	2	18	8	6	18	8	14
19	7	58	19	7	39	19	7	44	19	7	50
20	7	36	20	7	16	20	7	21	20	7	28
21	7	13	21	6	53	21	6	54	21	7	5
22	6	50	22	6	30	22	6	32	22	6	42
23	6	27	23	6	7	23	6	10	23	6	19
24	6	3	24	5	44	24	5	48	24	5	56
25	5	40	25	5	21	25	5	24	25	5	32
26	5	18	26	4	58	26	5	2	26	5	8
27	4	53	27	4	34	27	4	38	27	4	44
28	4	31	28	4	10	28	4	14	28	4	21
29	4	6									

South declination. South declination. South declination.

March.

Leapyeare.				First.				Second.				third.		
+				1				2				3		
1596				1597				1598				1599		
1600				1601				1602				1603		
1604				1605				1606				1607		
1608				1609				1610				1611		
1612				1613				1614				1615		
D	G	♈		D	G	♈		D	G	♈		D	G	♈
1	3	43		1	3	47		1	3	53		1	3	59
2	3	19		2	3	24		2	3	29		2	3	35
3	2	56		3	3	0		3	3	6		3	3	12
4	2	32		4	2	36		4	2	42		4	2	48
5	2	9		5	2	13		5	2	18		5	2	25
9	1	45		6	1	49		6	1	55		6	2	1
7	1	22		7	1	25		7	1	31		7	1	37
8	0	59		8	1	2		8	1	11		8	1	14
9	0	34		9	0	39		9	0	47		9	0	50
10	0	11		10	0	15		10	0	20		10	0	26
11	0	12		11	0	8		11	0	3		11	0	3
12	0	36		12	0	32		12	0	27		12	0	21
13	0	59		13	0	56		13	0	51		13	0	44
14	1	23		14	1	19		14	1	14		14	1	8
15	1	46		15	1	43		15	1	37		15	1	31
16	2	10		16	2	6		16	2	1		16	1	55
17	2	33		17	2	30		17	2	24		17	2	18
18	2	56		18	2	54		18	2	48		18	2	41
19	3	20		19	3	17		19	3	11		19	3	5
20	3	43		20	3	41		20	3	34		20	3	28
21	4	6		21	4	3		21	3	57		21	3	52
22	4	29		22	4	27		22	4	21		22	4	15
23	4	52		23	4	50		23	4	44		23	4	38
24	5	15		24	5	13		24	5	7		24	5	1
25	5	38		25	5	36		25	5	30		25	5	24
26	6	1		26	5	59		26	5	53		26	5	47
27	6	23		27	6	21		27	6	15		27	6	10
28	6	46		28	6	44		28	6	38		28	6	33
29	7	8		29	7	6		29	7	1		29	6	56
30	7	30		30	7	29		30	7	23		30	7	19
31	7	52		31	7	51		31	7	46		31	7	42

South declination. Equi nocti all. South declination. North declination. North decination. South declination. North declination.

April.

Leap years.			First.			Second.			Third.		
4			1			2			3		
1596			1597			1598			1599		
1600			1601			1602			1603		
1604			1605			1606			1607		
1608			1609			1610			1611		
1612			1613			1614			1615		
☉	☾	♍	☉	☾	♍	☉	☾	♍	☉	☾	♍
1	8	15	1	8	13	1	8	8	1	8	10
2	8	37	2	8	35	2	8	30	2	8	25
3	8	58	3	8	57	3	8	52	3	8	47
4	9	19	4	9	19	4	9	14	4	9	9
5	9	41	5	9	41	5	9	36	5	9	30
6	10	2	6	10	2	6	9	57	6	9	52
7	10	23	7	10	23	7	10	18	7	10	13
8	10	44	8	10	44	8	10	40	8	10	34
9	11	6	9	11	5	9	11	1	9	10	55
10	11	25	10	11	25	10	11	21	10	11	16
11	11	46	11	11	45	11	11	42	11	11	36
12	12	6	12	12	6	12	12	2	12	11	56
13	12	26	13	12	26	13	12	22	13	12	16
14	12	46	14	12	46	14	12	45	14	12	36
15	13	5	15	13	6	15	13	3	15	12	56
16	13	25	16	13	25	16	13	23	16	13	16
17	13	44	17	13	44	17	13	42	17	13	35
18	14	3	18	14	4	18	14	1	18	13	55
19	14	22	19	14	22	19	14	20	19	14	14
20	14	40	20	14	41	20	14	38	20	14	32
21	14	59	21	14	59	21	14	58	21	14	51
22	15	17	22	15	17	22	15	15	22	15	9
23	15	35	23	15	35	23	15	33	23	15	27
24	15	52	24	15	53	24	15	50	24	15	45
25	16	9	25	16	10	25	15	8	25	16	2
26	16	27	26	16	27	26	16	25	26	16	19
27	16	45	27	16	44	27	16	42	27	16	36
28	17	0	28	17	1	28	16	58	28	16	53
29	17	16	29	17	17	29	17	14	29	17	9
30	17	32	30	17	33	30	17	30	30	17	26

North declination. North declination. North declination.

May.

Leap yeare.			Firſt.			second.			Third.		
4			1			2			3		
1596			1597			1598			1599		
1600			1601			1602			1603		
1604			1605			1606			1607		
1608			1609			1610			1611		
1612			1613			1614			1615		
D	☉	☽	D	☉	☽	D	☉	☽	D	☉	☽
1	17	+8	1	17	+9	1	17	+5	1	17	+8
2	18	3	2	17	57	2	18	1	2	18	3
3	18	18	3	18	12	3	18	16	3	18	18
4	18	33	4	18	27	4	18	31	4	18	33
5	18	+8	5	18	+1	5	18	+5	5	18	+8
6	19	2	6	18	56	6	19	0	6	19	3
7	19	16	7	19	9	7	19	13	7	19	17
8	19	29	8	19	23	8	19	27	8	19	31
9	19	+2	9	19	36	9	19	+0	9	19	+3
10	19	56	10	19	+9	10	19	53	10	19	56
11	20	8	11	20	22	11	20	6	11	20	8
12	20	20	12	20	14	12	20	17	12	20	20
13	20	32	13	20	26	13	20	30	13	20	32
14	20	+3	14	20	38	14	20	+1	14	20	+2
15	20	54	15	20	+9	15	20	53	15	20	54
16	21	5	16	21	0	16	21	4	16	21	5
17	21	16	17	21	10	17	21	14	17	21	16
18	21	26	18	21	20	18	21	24	18	21	26
19	21	35	19	21	30	19	21	34	19	21	32
20	21	+5	20	21	39	20	21	+3	20	21	+1
21	21	54	21	21	+9	21	21	52	21	21	50
22	22	2	22	21	57	22	22	0	22	21	59
23	22	10	23	22	6	23	22	8	23	22	7
24	22	18	24	22	14	24	22	16	24	22	15
25	22	25	25	22	21	25	22	24	25	22	22
26	22	33	26	22	28	26	22	32	26	22	30
27	22	39	27	22	35	27	21	+0	27	22	36
28	22	+5	28	22	+1	28	22	+4	28	22	+2
29	22	51	29	22	+7	29	22	+9	29	22	+8
30	22	56	30	22	52	30	22	54	30	22	54
31	23	1	31	22	57	31	22	0	31	22	58

North declination.

North declination.

North declination.

Iune.

Leap yeare.				First.				Second.				Third.			
4				1				2				3			
1596				1597				1598				1599			
1600				1601				1602				1603			
1604				1605				1606				1607			
1608				1609				1610				1611			
1612				1613				1614				1615			
D	G	H		D	G	H		D	G	H		D	G	H	
1	23	0		1	23	4		1	23	4		1	23	3	
2	23	7		2	23	9		2	23	8		2	23	7	
3	23	12		3	23	13		3	23	12		3	23	11	
4	23	16		4	23	16		4	23	16		4	23	15	
5	23	19		5	23	19		5	23	20		5	23	18	
6	23	22		6	23	22		6	23	22		6	23	21	
7	23	24		7	23	24		7	23	23		7	23	23	
8	23	26		8	23	26		8	23	25		8	23	25	
9	23	27	North	9	23	27	North	9	23	26	North	9	23	26	North
10	23	28	tropick	10	23	28	tropick	10	23	27	tropick.	10	23	27	tropick.
11	23	28	declination.	11	23	28	declination.	11	23	28	declination.	11	23	28	declination.
12	23	28		12	23	28		12	23	28		12	23	28	
13	23	28		13	23	28		13	23	28		13	23	28	
14	23	27		14	23	27		14	23	28		14	23	27	
15	23	25		15	23	26		15	23	26		15	23	26	
16	23	23		16	23	24		16	23	25		16	23	25	
17	23	20		17	23	22		17	23	23		17	23	23	
18	23	18		18	23	19		18	23	20		18	23	21	
19	23	15		19	23	16		19	23	17		19	23	18	
20	23	12		20	23	13		20	23	14		20	23	15	
21	23	8		21	23	9		21	23	10		21	23	11	
22	23	4		22	23	5		22	23	6		22	23	7	
23	22	59		23	23	1		23	23	2		23	23	4	
24	22	54		24	22	56		24	22	57		24	22	58	
25	22	49		25	22	51		25	22	52		25	22	53	
26	22	43		26	22	45		26	22	47		26	22	48	
27	22	39		27	22	38		27	22	40		27	22	41	
28	22	30		28	22	32		28	22	34		28	22	35	
29	22	23		29	22	25		29	22	27		29	22	26	
30	22	15		30	22	18		30	22	20		30	22	21	

July.

Leap yeare.			First.			Second.			Third.		
4			1			2			3		
1596			1597			1598			1599		
1600			1601			1602			1603		
1604			1605			1606			1607		
1608			1609			1610			1611		
1612			1613			1614			1615		
☌	☾	☿	☌	☾	☿	☌	☾	☿	☌	☾	☿
1	22	12	1	22	10	1	22	14	1	22	21
2	22	4	2	22	2	2	22	4	2	22	6
3	21	56	3	21	54	3	21	56	3	21	58
4	21	47	4	21	45	4	21	47	4	21	49
5	21	38	5	21	35	5	21	38	5	21	40
6	21	28	6	21	26	6	21	28	6	21	30
7	21	19	7	21	16	7	21	19	7	21	21
8	21	9	8	21	6	8	21	6	8	21	11
9	20	58	9	20	55	9	20	58	9	21	0
10	20	48	10	20	44	10	20	47	10	20	49
11	20	39	11	20	33	11	20	36	11	20	38
12	20	29	12	20	21	12	20	24	12	20	26
13	20	19	13	20	9	13	20	12	13	20	14
14	19	59	14	19	57	14	20	0	14	20	6
15	19	49	15	19	44	15	19	47	15	19	49
16	19	37	16	19	31	16	19	34	16	19	36
17	19	25	17	19	17	17	19	20	17	19	23
18	19	12	18	19	4	18	19	7	18	19	10
19	18	59	19	18	52	19	18	53	19	18	56
20	18	45	20	18	38	20	18	38	20	18	43
21	18	31	21	18	24	21	18	24	21	18	28
22	18	16	22	18	9	22	18	9	22	18	13
23	18	1	23	17	54	23	17	54	23	17	58
24	17	47	24	17	38	24	17	38	24	17	42
25	17	30	25	17	23	25	17	23	25	17	26
26	17	14	26	17	7	26	17	6	26	17	11
27	16	58	27	16	50	27	16	50	27	16	55
28	16	42	28	16	33	28	16	33	28	16	38
29	16	25	29	16	17	29	16	17	29	16	21
30	16	8	30	15	56	30	16	0	30	16	4
31	15	51	31	15	39	31	15	42	31	15	47

North declination.

North declination.

North declination.

August.

Leap yeare.				First.				Second.				third.		
+				L				2				3		
1596				1597				1598				1599		
1600				1601				1602				1603		
1604				1605				1606				1607		
1608				1609				1610				1611		
1612				1613				1614				1615		
D	G	P		D	G	P		D	G	P		D	G	P
1	15	15		1	15	21		1	15	25		1	15	30
2	14	57		2	15	3		2	15	7		2	15	12
3	14	39		3	14	45		3	14	49		3	14	54
4	14	20		4	14	27		4	14	31		4	14	36
5	14	2		5	14	8		5	14	12		5	14	18
6	13	43		6	13	49		6	13	53		6	13	59
7	13	24		7	13	30		7	13	34		7	13	40
8	13	5		8	13	9		8	13	15		8	13	20
9	12	41		9	12	51		9	12	56		9	13	2
10	12	25		10	12	31		10	12	36		10	12	41
11	12	5		11	12	12		11	12	16		11	12	23
12	11	45		12	11	52		12	11	56		12	12	3
13	11	25		13	11	32		13	11	36		13	11	43
14	11	4		14	11	11		14	11	16		14	11	22
15	10	44		15	10	51		15	10	59		15	11	2
16	10	23		16	10	30		16	10	35		16	10	41
17	10	2		17	10	9		17	10	14		17	10	20
18	9	41		18	9	48		18	9	53		18	9	59
19	9	19		19	9	27		19	9	31		19	9	39
20	8	58		20	9	5		20	9	10		20	9	16
21	8	35		21	8	44		21	8	49		21	8	55
22	8	15		22	8	22		22	8	27		22	8	33
23	7	53		23	8	0		23	8	5		23	8	11
24	7	31		24	7	38		24	7	43		24	7	50
25	7	9		25	7	16		25	7	21		25	7	28
26	6	47		26	6	53		26	6	59		26	7	5
27	6	25		27	6	31		27	6	36		27	6	43
28	6	1		28	6	9		28	6	14		28	6	20
29	5	39		29	5	46		29	5	51		29	5	57
30	5	16		30	5	23		30	5	28		30	5	34
31	4	53		31	5	0		31	5	5		31	5	11

North declination. North declination. North declination.

Semp ember,

Leap yeare.				First.				Second.				third			
4				1				2				3			
1596				1597				1598				1599			
1600				1601				1602				1603			
1604				1605				1606				1607			
1608				1609				1610				1611			
1612				1613				1614				1615			
D	G	M		D	G	M		D	G	M		D	G	M	
1	4	43		1	4	38		1	4	42		1	4	49	
2	4	20		2	4	14		2	4	20		2	4	26	
3	3	57	North declination.	3	3	51	North declination.	3	3	56	North declination.	3	4	3	North declination.
4	3	34		4	3	28		4	3	33		4	3	39	
5	3	12		5	3	5		5	3	10		5	3	16	
6	2	47		6	2	37		6	2	47		6	2	53	
7	2	24		7	2	18		7	2	23		7	2	29	
8	2	1		8	1	55		8	2	0		8	2	6	
9	1	37		9	1	31		9	1	37		9	1	43	
10	1	14		10	1	8		10	1	13		10	1	19	
11	0	51	Equi	11	0	45	nocti	11	0	49	all.	11	0	56	all.
12	0	27		12	0	21		12	0	26		12	0	32	
13	0	3		13	0	21		13	0	3		13	0	9	
14	0	20		14	0	25		14	0	21		14	0	15	
15	0	43		15	0	48		15	0	44		15	0	38	
16	1	7		16	1	12		16	1	8		16	1	2	
17	1	30	South declination.	17	1	35	South declination.	17	1	31	South declination.	17	1	25	South declination.
18	1	54		18	1	58		18	1	55		18	1	48	
19	2	17		19	2	22		19	2	18		19	2	12	
20	2	41		20	2	45		20	2	45		20	2	35	
21	3	4		21	3	9		21	3	5		21	2	59	
22	3	27		22	3	32		22	3	28		22	3	22	
23	3	50		23	3	55		23	3	51		23	3	45	
24	4	14		24	4	18		24	4	15		24	4	9	
25	4	37		25	4	41		25	4	38		25	4	32	
26	5	0		26	5	4		26	5	1		26	4	55	
27	5	23		27	5	27		27	5	23		27	5	18	
28	5	46		28	5	51		28	5	46		28	5	41	
29	6	8		29	6	14		29	6	9		29	6	4	
30	6	31		30	6	36		30	6	32		30	6	26	

October.

Leap yeare.			First.			Second.			Third.		
4			1			2			3		
1590			1597			1598			1599		
1600			1601			1602			1603		
1604			1605			1606			1607		
1608			1609			1610			1611		
1612			1613			1614			1615		
D	G	P	D	G	P	D	G	P	D	G	P
1	6	53	1	7	C	1	6	54	1	6	48
2	7	16	2	7	22	2	7	17	2	7	11
3	7	38	3	7	44	3	7	39	3	7	33
4	8	1	4	8	7	4	8	1	4	7	55
5	8	23	5	8	29	5	8	24	5	8	18
6	8	45	6	8	5	6	8	46	6	8	40
7	9	7	7	9	13	7	9	8	7	9	2
8	9	30	8	9	36	8	9	30	8	9	29
9	9	52	9	9	58	9	9	52	9	9	42
10	10	13	10	10	19	10	10	13	10	10	8
11	10	35	11	10	41	11	10	35	11	10	29
12	10	56	12	11	2	12	11	0	12	10	51
13	11	17	13	11	23	13	11	18	13	11	12
14	11	39	14	11	45	14	11	39	14	11	33
15	11	59	15	12	5	15	12	0	15	11	54
16	12	20	16	12	26	16	12	21	16	12	15
17	12	41	17	12	47	17	12	41	17	12	36
18	13	1	18	13	7	18	13	1	18	12	56
19	13	21	19	13	27	19	13	22	19	13	17
20	13	41	20	13	47	20	13	41	20	13	36
21	14	1	21	14	6	21	14	1	21	13	56
22	14	17	22	14	26	22	14	21	22	14	16
23	14	39	23	14	45	23	14	40	23	14	35
24	14	58	24	15	4	24	14	59	24	14	54
25	15	17	25	15	23	25	15	17	25	15	13
26	15	35	26	15	41	26	15	36	26	15	31
27	15	54	27	15	59	27	15	54	27	15	50
28	16	12	28	16	17	28	16	12	28	16	8
29	16	29	29	16	35	29	16	30	29	16	25
30	16	47	30	16	52	30	16	47	30	16	43
31	17	4	31	17	9	31	17	4	31	17	0

South declination. South declination. South declination.

Nouember.

Leap yeare.			South declination.	First.			South declination.	Second.			South declination.	Third.		
4				1				2				3		
1596				1597				1598				1599		
1600				1601				1602				1603		
1604				1605				1606				1607		
1608				1609				1610				1611		
1612				1613				1614				1615		
☉	☾	♍		☉	☾	♍		☉	☾	♍		☉	☾	♍
1	17	36		1	17	26		1	17	21		1	17	17
2	17	53		2	17	42		2	17	38		2	17	33
3	18	5		3	17	58		3	17	54		3	17	49
4	18	25		4	18	14		4	18	9		4	18	6
5	18	41		5	18	29		5	18	25		5	18	22
6	18	55		6	18	44		6	18	40		6	18	37
7	19	10		7	18	59		7	18	55		7	18	52
8	19	24		8	19	14		8	19	10		8	19	6
9	19	38		9	19	26		9	19	24		9	19	21
10	19	50		10	19	42		10	19	36		10	19	35
11	20	5		11	19	45		11	19	52		11	19	48
12	20	18		12	20	8		12	20	5		12	20	4
13	20	30		13	20	21		13	20	18		13	20	14
14	20	43		14	20	34		14	20	30		14	20	27
15	20	54		15	20	46		15	20	42		15	20	39
16	21	6		16	20	57		16	20	54		16	20	51
17	21	17		17	21	8		17	21	5		17	21	3
18	21	27		18	21	19		18	21	16		18	21	14
19	21	37		19	21	29		19	21	27		19	21	24
20	21	47		20	21	39		20	21	37		20	21	35
21	21	56		21	21	49		21	21	47		21	21	44
22	22	5		22	21	58		22	21	56		22	21	54
23	22	14		23	22	7		23	22	5		23	22	3
24	22	21		24	22	15		24	22	14		24	22	11
25	22	29		25	22	23		25	22	24		25	22	19
26	22	36		26	22	31		26	22	29		26	22	27
27	22	43		27	22	38		27	22	37		27	22	34
28	22	49		28	22	44		28	22	43		28	22	41
29	22	55		29	22	50		29	22	49		29	22	47
30	23	0		30	22	56		30	22	54		30	22	53

December.

Leapyeare.				First.				Second.				third.		
4				1				2				3		
1596				1597				1598				1599		
1600				1601				1602				1603		
1604				1605				1606				1607		
1608				1609				1610				1611		
1612				1613				1614				1615		
☉	☾	♑		☉	☾	♑		☉	☾	♑		☉	☾	♑
1	23	1		1	23	1		1	23	0		1	23	1
2	23	10		2	23	6		2	23	5		2	23	10
3	23	14		3	23	10		3	23	9		3	23	14
4	23	17		4	23	14		4	23	13		4	23	17
5	23	20		5	23	17		5	23	17		5	23	19
6	23	22		9	23	20		6	23	20		6	23	21
7	23	25		7	23	23		7	23	22		7	23	24
8	23	26		8	23	25		8	23	25		8	23	26
9	23	27	South	9	23	26	South	9	23	26	South	9	23	27
10	23	28	tropick.	10	23	27	tropick.	10	23	27	tropick	10	23	28
11	23	28		11	23	28		11	23	28		11	23	28
12	23	28		12	23	28		12	23	28		12	23	28
13	23	27		13	23	28		13	23	28		13	23	27
14	23	26		14	23	27		14	23	27		14	23	26
15	23	24		15	23	26		15	23	26		15	23	24
16	23	21		16	23	24		16	23	24		16	23	21
17	23	18		17	23	21		17	23	22		17	23	18
18	23	15		18	23	19		18	23	20		18	23	15
19	23	12		19	23	16		19	23	17		19	23	12
20	23	8		20	23	12		20	23	13		20	23	8
21	23	6		21	23	8		21	23	7		21	23	5
22	22	57		22	23	3		22	23	4		22	22	57
23	22	52		23	22	58		23	22	59		23	22	53
24	22	46		24	22	52		24	22	54		24	22	46
25	22	40		25	22	47		25	22	48		25	22	40
26	22	33		26	22	40		26	22	42		26	22	33
27	22	25		27	22	36		27	22	35		27	22	25
28	22	18		28	22	30		28	22	28		28	22	18
29	22	9		29	22	22		29	22	20		29	22	9
30	22	0		30	22	14		30	22	12		30	22	0
31	21	52		31	22	6		31	22	4		31	21	52

South declination.

Howe to vse the Sonnes declination to knowe the Poles elevation.

FIrst consider, whether the Sunne hath North or South declination, which you shall know by the former tables, and if the Sunne hath North declination substract the meridian altitude thereof from 90. and to the rest adde the declination for the day proposed, but if the Sun hath South declination, adde the declination to the meridian altitude, the same substract from .90. the rest is the elevation of the Pole. Example at London the 16. of Aprill. 1596. the declination is North 13 degrees, 25 minutes, and the height of the Sun vpon the meridian, is 51 degrees, 43 minutes, which taken from 90. rests 38. degrees, 17 minutes, the same added to the declination 13 degrees 25 minutes, makes 51 degrees 42 minutes, and so much is the height of the Pole. Againe the 21 of Ianuarie, the Sun hath South declination 17 degrees, 36 minutes, and I finde the meridian altitude to be 20 degrees, 42. minutes, which added togeather makes 38 degrees, 18 minutes: the same substract from 90 degrees, rests 51 degrees, 42 minutes, the elevation aforesaide. But this is vnderstoode when you knowe certainely on which side of the Equinoctiall you are: to knowe which, do thus. If the Sun cast his shadow that way that hee is from the Equinoctiall he is betwixt you and it, and if the Sun hauing North declination giue a South shadow, or South declinat giue a North shadowe, then is the equator betwixt you and the Sunne, or you in the equator, or you betwixt the equator and the Sun: to know which, adde the declination to the meridian altitude, if it be lesse, then .90. so much as wanteth of .90. is your distaunce from the equator on that side which the shadowe streeketh: but if it amount to .90. then are you vnder the equator: if more, then 90 so much as is the ouerplus are you from the equator towards the Sun, and then are you betwixt the equator and the Sun: also if the meridian altitude be equall with your Zenith, so much as is the declination of the Sunne are you distaunt from the equator, on that side wherein the sunne is, but if the sun haue no declination, then are you vnder the Equinoctiall.

Heere fol-

Heere followeth an Almanacke, whereby may bee knowne the Prime, Epact & Dominicall letter: as also the mooueable Feastes for 24. yeares to come.

Which Almanacke is to be referred to the Kalender in the beginning of the booke.

Anno Domini.	The prime.	The Epact.	The Sunday leter.	Easter dates.	Rogation Sunday.	Ascention day.	Whitsonday.	betwixt Whitsonride and Midsommer. week.	date
1596	1	11	D	11. April.	16. May.	20. May.	30. May.	3.	4
1597	2	22	C B A G	27. March.	1. May.	5. May.	15. May.	5.	5
1598	3	3	F	16. April.	21. May.	25. May.	4. June.	2.	6
1599	4	14	E D C B	8. April.	13. May.	17. May.	27. May.	4.	0
1600	5	25	A	23. March.	27. April	1. May.	11. May.	6.	2
1601	6	6	G F E D	12. April.	17. May.	21. May.	31. May.	3.	3
1602	7	17	C	4. April.	9. May.	12. May.	23. May.	4.	4
1603	8	28	B A G F	24. April.	29. May.	2. June.	12. June.	1.	5
1604	9	9	E	8. April.	13. May.	17. May.	27. May.	4.	0
1605	10	20	D C B A	31. March.	5. May.	9. May.	19. May.	5.	1
1606	11	1	G	20. April.	25. May.	29. May.	8. June.	2.	2
1607	12	12	F E D C	5. April.	10. May.	14. May.	24. May.	4.	3
1608	13	23	B	27. March.	1. May.	5. May.	15. May.	5.	5
1609	14	4	A G F E	16. April.	21. May.	25. May.	4. June.	2.	6
1610	15	15	D	1. April.	6. May.	10. May.	20. May.	5.	0
1611	16	26	C B A G	24. March.	28. April	2. May.	12. May.	6.	1
1612	17	7	F	12. April.	17. May.	21. May.	31. May.	3.	3
1613	18	18	E D C B	4. April.	9. May.	13. May.	23. May.	4.	4
1614	19	29	A	7. April.	22. May.	26. May.	5. June.	2.	5
1615	1	11	G F E D	9. April.	14. May.	18. May.	28. May.	3.	6
1616	2	22	C B A G	31. March	5. May.	9. May.	19. May.	5.	1
1617	3	3	F	13. April.	18. May.	22. May.	1. June.	3.	2
1618	4	14	E D C B	5. April.	10. May.	14. May.	24. May.	4.	3
1629	5	25	A	28. March.	2. May.	6. May.	16. May.	5.	4

The vse of the former Almanacke.

If you desire to know the Prime, Epact, the Dominicall letter, Easter day, Rogation Sunday, Ascention day, Whitsonday or the space betwixt Whitsonday and Midsommer, by the Almanack before specified: do thus, looke in the first collomne, towards the left hand for the yeare in which you would knowe the premises aforesaid, and right against the same towards the right hand, you shall finde all of them vnder their titles.

As for Example.

This present yeare 1596. I desire to knowe the saide: First I seeke in the neerest collomne leftward the yeare of 1596. and against the same vnder the title Prime, I finde 1. next vnder the title Epact, 11. vnder Easter day, 11 Aprill: vnder Rogation Sonday, 16 May: vnder Ascention day. 20 May, vnder Whitsonday, 35. May: and the space betwixt Whitsontide and Midsommer, 3 weekes and 4 dayes.

A Table which by the helpe of the Letters in the last collomne of the Kalender (in the beginning of the booke) wil shewe in what signe the Moone is at all times: the vse whereof is thus.

If you desire to finde in what signe of the Zodiacke the ☾ is at any time, first resort to the Kalender, which is in the beginning of this booke, and in the last collomne of the moneth vnder the Caracter ☾ of the Moone, directly against the day of the moneth, you shall finde one of the 24 letters: which bearing in memorie, looke the Prime in the page next before, then finding the same prime in the head of this table, & descending by the saide coolmne of the prime til you finde the letter which you beare in memorie, and right against the same letter in the outmost collomne, towards the left hand, is the name of the signe, which the ☾ then possesseth: Example, against the first of Aprill I finde the letter B. and the prime by the former rule 1. then going downe-ward vnder the title 1. which I finde in the head of the table, till I come to the letter B. against the same is Virgo, the desired signe.

A table wherin is shewed at all times, what signe the Moone shalbe in, by the Prime & helpe of the letters, in the last Colomne of the Kalender (in the beginning of the booke) as by example is hereafter shewed.

The Prime.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Aries.	y	n	c	v	l	ſt	ſ	h	z	p	e	u	m	a	s	i	ꝛ	q	f
Aries.	z	o	d	u	m	a	s	i	ꝛ	q	f	r	n	b	t	k	ſt	r	g
Aries.	ꝛ	p	e	r	n	b	t	k	ſt	r	g	y	o	c	v	l	a	ſ	h
Taurus.	ſt	q	f	y	o	c	v	l	a	ſ	h	z	p	d	u	m	b	s	i
Taurus.	a	r	g	z	p	d	u	m	b	s	i	ꝛ	q	e	r	n	c	t	k
Gemini.	v	ſ	h	ꝛ	q	e	r	n	c	t	k	ſt	r	f	y	o	d	v	l
Gemini.	c	s	i	ſt	r	f	y	o	d	v	l	a	ſ	g	z	p	e	u	m
Cancer.	d	t	k	a	ſ	g	z	p	e	u	m	b	s	h	ꝛ	q	f	r	n
Cancer.	e	v	l	b	s	h	ꝛ	q	f	r	n	c	t	i	ſt	r	g	y	o
Leo.	f	u	m	c	t	i	ſt	r	g	y	o	d	v	k	a	ſ	h	z	p
Leo.	g	r	n	d	v	k	a	ſ	h	z	p	e	u	l	b	s	i	ꝛ	q
Leo.	h	y	o	e	u	l	b	s	i	ꝛ	q	f	r	m	c	t	k	ſt	r
Virgo.	i	z	p	f	r	m	c	t	k	ſt	r	g	y	n	d	v	l	a	ſ
Virgo	k	ꝛ	q	g	y	n	d	v	l	a	ſ	h	z	o	e	u	m	b	s
Libra.	l	ſt	r	h	z	o	e	u	m	b	s	i	ꝛ	p	f	r	n	c	t
Libra.	m	a	ſ	i	ꝛ	p	f	r	n	c	t	k	ſt	q	g	y	o	d	v
Scorpio.	n	b	s	k	ſt	q	g	y	o	d	v	l	a	r	h	z	p	e	u
Scorpio.	o	c	t	l	a	r	h	z	p	e	u	m	b	ſ	i	ꝛ	q	f	r
Sagittarius.	p	d	v	m	b	ſ	i	ꝛ	q	f	r	n	c	s	k	ſt	r	g	y
Sagittarius.	q	e	u	n	c	s	k	ſt	r	g	y	o	d	t	l	a	ſ	h	z
Sagittarius.	r	f	r	o	d	t	l	a	ſ	h	z	p	e	v	m	b	s	i	ꝛ
Capricorne	ſ	g	y	p	e	v	m	b	s	i	ꝛ	q	f	u	n	c	t	k	ſt
Capricorne.	s	h	z	q	f	u	n	c	t	k	ſt	r	g	r	o	d	v	l	a
Aquarius.	t	i	ꝛ	r	g	r	o	d	v	l	a	ſ	h	y	p	e	u	m	b
Aquarius.	v	k	ſt	ſ	h	y	p	e	u	m	b	s	i	z	q	f	r	n	c
Pisces.	u	l	a	s	i	z	q	f	r	n	c	t	k	ꝛ	r	g	y	o	d
Pisces.	r	m	b	t	k	ꝛ	r	g	y	o	d	v	l	ſt	ſ	h	z	p	e
Pisces.	y	n	c	v	l	ſt	ſ	h	z	p	e	u	m	a	s	i	ꝛ	q	f

Hereafter followeth a table with which by helpe of the instrument placed in the 18 Chapter of the second parte, you may know the tides in all the said places.

A North or South	Moone	makes full sea at the lands ende at Southhampton, at the Spittes, at the Sleue, all along the Swine, and at Quinbrough.
North and by East / South and by West		At the Weast ende of the Norre at Redban and at Aberden.
North Norre East / South South West		At the holye Ilande, at Tinmouth, at Grauts ende.
No East and by No / So West and by So		At Dondy, and at Saint Androwes.
North East / South West		Betweén Tinmouth & Flambrough head, At London, at Dffing, at Hartlepoole, and from the Pole-head of Burdeaur, all alongst the coast of Byscaye, Galiza, and Portingall to the straights of Maliga.
No East & by East / So West & by west		Betwéne Flambrough head & Brighton At Barwicke, and at Flushing.
Easte North Easte / West South Weast		At Erith, at Lieth, at Dunbar, at landes end of the gulfe, and betweene Brighton, and Laurenas, and at Silly.
East and by Nore / West & by South		At Padsto, at Barstable, at Ilfracone, at Waterford, at Joholl, at Cork, at Kinsale, at Low, at Foy, and at Falmoth.
East / West		At Waimouth, at Dartmouth, at Ermouth At Tingmouth, at Linne, at Salcome at Plymouth, at Mounts-bay, at Lin at Humber, betweene Laurenas and Cromer.

East

East and by South / West and by Nore } At Bristoll.

East South Easte / Weast Nore West } At Milforde, at Bridgewater, and at Eywater.

So East and by East / No West & by We } At Peter Porte.

South East / Nore West } At Poole, at Portland, and betweene Cromer and Yarmouth rode to Leisto, North rode at Orkney.

South East and by South, Nore West and by Nore } Betweene Leisto rode and Orfordnes to the Westwarde of Beche, at the Ilande at the Needles, at Deepe, at Lur, at Lenois.

South South East / Nore Nore West } Betweene Orforde, and Orwell, at the North Forlande, at Saint Ellins, at Douer, at Harwich, at Yarmouth, and at Boleine.

South and by East / No and by Weast } At the Gorend, betweene the Nase, and the Wars heade of Coluer, at Porchmouth at Callis, and from the Wellings, to Callis.

This former Table which I haue heere gathered, is onely to knowe vpon what point of the compasse the Moone must be to make high water in any of the places aforesaide, which knowne for to finde the time of the Moones beeing vpon the saide points, and thereby the tides: resort to the 18 Chapter of the second parte for your further instruction.

FINIS.

A Table of the Chapters conteyned in this Booke.

The contents of the first part.

First before the booke is a kallender.
Of the generll distinction of Creatures Fol.1
The definition of the world. Fol.eadem
The definition of the Spheares, Fol.2
The deuision of the worlde. Fol.eadem
The number, order, and properites of the Heauens and Elements. Fol.3
Of the immutabilitie of the earth. Fol.4
Of the roundnes of the earth and water. Fol.5
The motion of the heauens and elements. Fol.6
Of the definition of the spheare into formall partes, Fol.7
Of the Equinoctiall circle. Fol.8
Of the Zodiack circle. Fol.9
Of the circles called Colury. Fol.10
Of the meridian circle. Fol.eadem
Of the Horizontall circle. Fol.11
Of the foure lesser circles. Fol.12
Of the fiue Zones. Fol.13
Of longitude and latitude, and of the poprortion which the lesser circles haue to the greater. Fol.14
The compasse of the earth and water. Fol.15
Of the seauen climates. Fol.eadem
Certeine principles of this science. Fol.17

The contents of the second part.

The course of the Sunne in the Zodiacke. Fol.18
Of the true place of the Sunne in the zodiack. Fol.20
The declination of the Sunne according to the signes, Fol.22
The increase of the Sunne into the twelue signes and of the Equinoctialls and solstitials, which deuide the yeare into fowre quarters. Fol.23
Of the Moone, and her properties and motion. Fol.25

The Con-

The Coniunctions and oppositions of the Sun & Moone. Fol. 26
The declination and vse of an instrument for the motion of the Sunne and Moone. Fol. 28
Of the Eclipse of the Sunne and Moone. Fol. 30
Of time and the definition thereof. Fol. 32
Of the yeere and the diuers kindes thereof. Fol. eadem.
Of the month and his differences. Fol. 34
Of the weeke. Fol. 35
Of the day and night. Fol. eadem
Of houres. Fol. 36
The making and vse of an vniuersall Diall for the day. Fol. 37
Of Dials murall and Horizontall. Fol. 39
An instrument for the houres of the night. Fol. 41
Of the time, of the tides, or the rising and falling of the sea, with a newe instrument to the same purpose Fol. 44
Certeine signes which prognosticate tempests or faire weather. Fol. 46
Of the bright and shining exhalations that appeare in tempestes, which the Marriners call Santelmo. Fol. 48

The contents of the third part.

The number, order, and names of the windes. Fol. 50
The demonstration of windes. Fol. 52
The composition of Cardes for the sea. Fol. eadem
The manner of translating the Carde, from one forme to another greater or lesse. Fol. 57
The vertue and propertie of the Loadstone. Fol. 58
The making of the Marriners compasse for Nauigation Fol. 59
The effect or propertie that the compas hath to the Northeasting or Northwesting, whereby is knowne the variation of the Compas. Fol. 61
The demonstration of Northeasting. Fol. 62
The introduction & principles of the Art of Nauigation. Fol. 63
The making and vse of the Astrolabie, with the which the Mariners take the altitude of the Sunne. Fol. 64
The definition of the altitude, and how the altitude of the Pole may well be knowne by the Meridian altitude, and eleuation of the

the Sunne. Fol.67
The making of the croſſe ſtaffe where with the Marriners take the altitude of the North ſtarre. Fol.68
The compoſition and vſe of an inſtrument, by the which without obſeruing the South ſunne or midday, is knowne the altitude of the pole, and the houre that is. Fol.72
The leagues that are runne for a degree, according vnto diuers courſes. Fol.75
How to ſet or make a prick in the Carde of Nauigation Fol.76
The making and vſe of the inſtrument generally to knowe the houres and quantities of the day, and at what Winde the Sun riſeth and falleth. Fol.77
The trace or draught of the inſtrument. Fol.78
The demonſtration. Fol.79

An Addition to the Arte of Nauigation.

The declination of the Sunne for euery, month and day of the month throughout the yeare. Fol.80
How to vſe the Sunnes declination, to knowe the Poles eleuation. Fol.86
An Almanacke, whereby may be known the Pryme, Epact, and Dominical Letter as alſo the mooueable feaſtes for 24. yeeres to come. Which Almanacke is to be referred to the Kalender, in the beginning of the booke. Fol.87
A Table which by the helpe of the letters in the laſt colomne of the Kalender in the beginning of the booke, will ſhewe in what ſigne the Moone is at all times. Fol.eadem
A Table, with which by helpe of the inſtrument placed in the 18 Chapter of the ſecond parte, you may know the tides in ſundry places. Fol.89

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